The Welding Engineer

Founded by L. B. Mackenzie, 1916

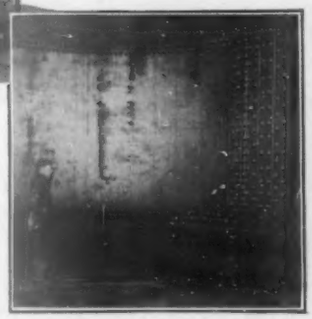
MARCH, 1927 VOL. 12, No. 3

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. Reg. U. S. Pat. Office $4.00 per year abroad

1½ miles of arc-welding in each big stack

—every inch a Wilson Weld!

At the **New York Edison Plant** *14th Street and East River*



Above: One of the seven arc-welded stacks at the Edison Plant, 14th Street and East River, New York. Height of each stack: 256 feet above roof; diameter: 22½ feet. Right: Interior of stack, showing welded seams.

WHEN the power house of the New York Edison Co., at 14th Street and East River, New York, is completed, each of the seven stacks that tower above the roof will contain 7,500 feet (1⅛ miles) of arc-welding—a total of nearly 10 miles—one of the biggest welding jobs ever attempted!

And every inch of the 1⅛ miles of welding in the stack pictured above was made with Wilson Welding Machines and Wilson "Color-tipt" Welding Wire—Grade No. 17 (patented U. S. A., June 13, 1916; March 9, 1920) diameter 5/32", at 150 amperes. The third of the seven stacks is now being constructed.

In addition to the 52,500 feet of welding in the seven giant stacks, the seams on the horizontal flues between the stacks and in the cinder catcher are being welded, and all rivets welded over as protection against corrosion from the acid fumes that form in the cinder catcher. The rivets are being welded over with Wilson Grade No. 0. The seams are being welded with Wilson Grade No. 9 (patented U. S. A., June 13, 1916; March 9, 1920) diameter 5/32", at 145 amperes.

This phenomenal welding job at the Edison plant is another illustration of the adaptability of Wilson Wire to practically every welding problem. No matter what industry you are in, there is a grade (analysis) of Wilson "Color-tipt" Welding Wire that will meet your own particular welding needs—and there is a Wilson Welding Machine that will meet your own particular operating conditions.

Write today for a sample of Wilson Wire—just indicate the kind of metal you desire to weld. Also, ask for bulletins describing Wilson Welding Machines.

WILSON WELDER & METALS CO. INC., WILSON BUILDING, HOBOKEN N. J.

WILSON

WELDING MACHINES AND WELDING WIRE

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill. Under the Act of March 3, 1897.

It is a part of the Linde square deal

BUSINESS friendship, like personal friendship, is based on mutual liking and mutual trust. It begins when promises are kept. It is fostered by aiding customers in the efficient and economical use of a product.

Linde can speak with authority on the subject because Linde customers are Linde's friends. They stick to Linde because they have always had a square deal its 19 years of life.

Linde service is one of the reasons. This means, in the first place, that when you order oxygen from Linde your order can be filled immediately. And this statement holds good anywhere in the country, for Linde has 37 plants and stocks in 107 warehouses.

In addition to a sure supply of oxygen, Linde, through its service organization, shows you how to use the oxy-acetylene process efficiently and economically.

It is part of the Linde square deal.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
General Offices: Carbide and Carbon Building
30 East 42d Street, New York
37 PLANTS . . . . . 107 WAREHOUSES

LINDE OXYGEN

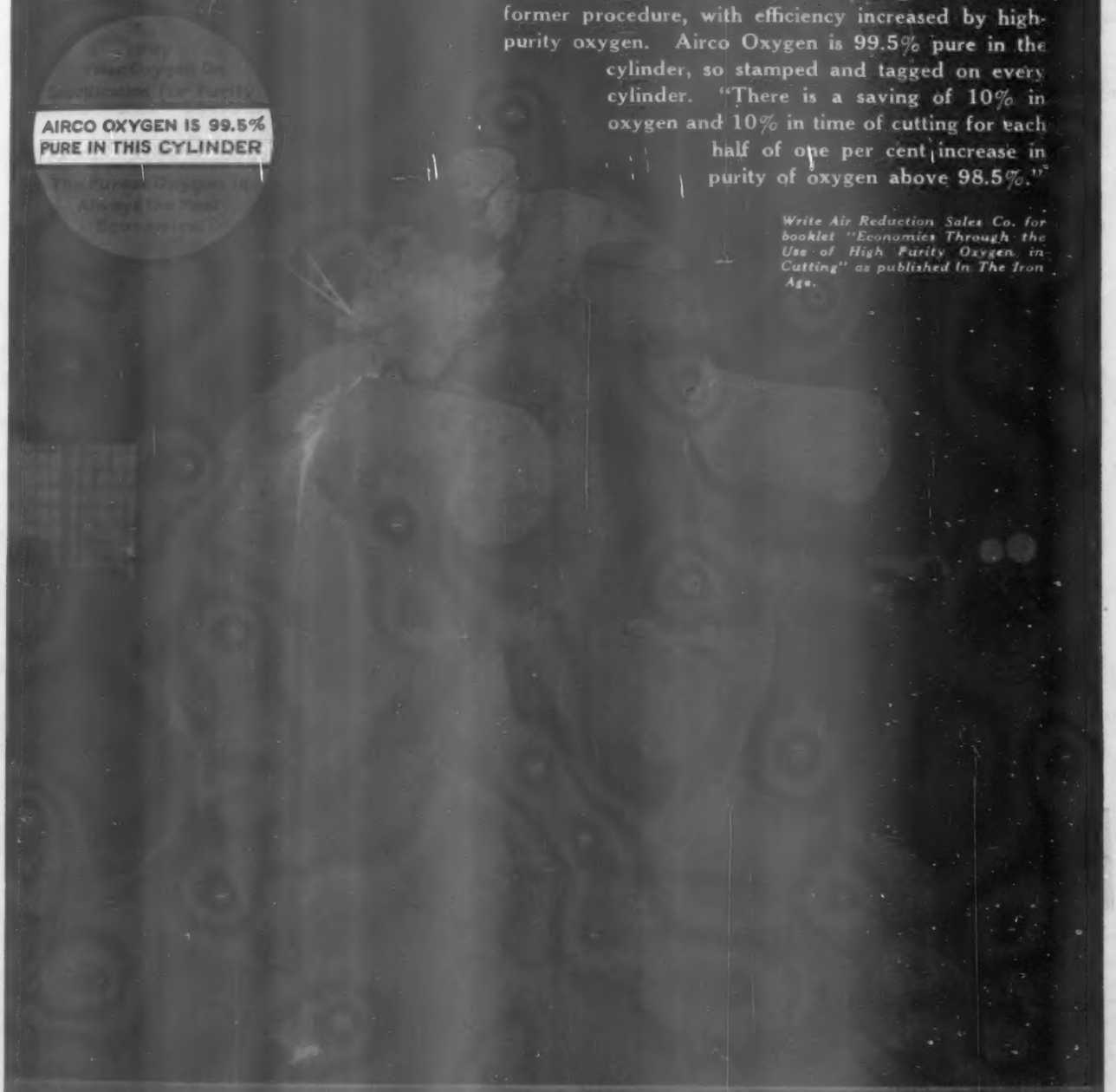
Cutting 16-Inch Risers on a 20-Ton Steel Casting with Airco 99.5% Pure Oxygen and the Oxyacetylene Cutting Torch

THIS TAG IS ON EVERY AIRCO OXYGEN CYLINDER

AIRCO OXYGEN IS 99.5% PURE IN THIS CYLINDER

A more simple, time-saving, cost-saving method than former procedure, with efficiency increased by high-purity oxygen. Airco Oxygen is 99.5% pure in the cylinder, so stamped and tagged on every cylinder. "There is a saving of 10% in oxygen and 10% in time of cutting for each half of one per cent increase in purity of oxygen above 98.5%."

Write Air Reduction Sales Co. for booklet "Economies Through the Use of High Purity Oxygen in Cutting" as published in The Iron Age.



OXYGEN CALORENE AIRCO ACETYLENE CARBIDE

AIRCO-DAVIS-BOURNONVILLE APPARATUS

6 DISTRIBUTING POINTS 6 DISTRICT OFFICES

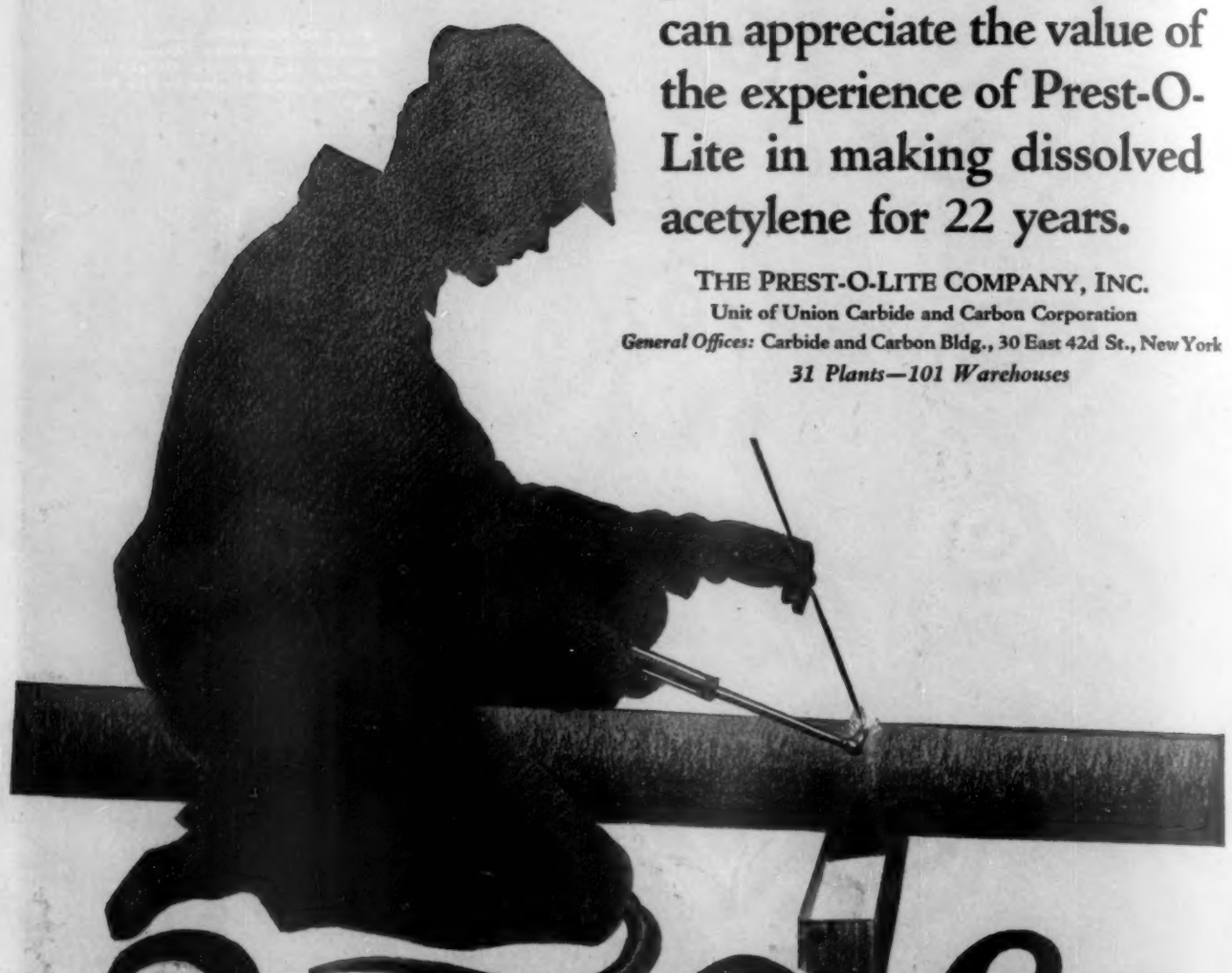
Air Reduction Sales Company

342 MADISON AVENUE NEW YORK, N.Y.

Experience

You who have had years of experience in manufacturing realize how experience is reflected in the product. Therefore you can appreciate the value of the experience of Prest-O-Lite in making dissolved acetylene for 22 years.

THE PREST-O-LITE COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
General Offices: Carbide and Carbon Bldg., 30 East 42d St., New York
31 Plants—101 Warehouses



Prest-O-Lite
DISSOLVED ACETYLENE

The Welding Engineer

Founded by L. B. Mackenzie, 1916

Volume 12 March, 1927 Number 3

CONTENTS

Welding Reduces Power House Costs 25
By T. E. DePew
Pipe Welding Under Difficulties 29
By George Walker
"Let's Go," on Structural Welding 31
By C. J. Holslag
Wrenches Made to Order 33
By Will Stewart
Investigating Spot Welds 35
Some Facts About Welded Joints 37
By S. J. Melville
Editorial 23
Welding at Newport News Shipyard 30
Welding Conference at North Texas Agricultural College 32
74 Mile Welded Gas Line 32
Welded Fly Wheel 36
Welds Hold When Pressure Vessel Is Destroyed 36
Welding an Engine Without Dismantling 39
Cutting Metals Under Water 39
Care of Welding Hose 40
Welding a Broken Pulley 42
Fall Meeting of A. W. S. 42
G. P. A. Films Now Available 43
News of the Welding Trade 46

Making Things Too Easy

WHAT a simple task it would be to buy equipment and materials if standard specifications could be drawn up to cover the requirements of the buyer fully! "How much is it?" and "How soon can we get it?" would be all the questions needed to make a trade. That's too easy. Any such specifications would kill the initiative of manufacturers in perfecting their products. Specifications serve the purpose of keeping out the eminently undesirable. They should be so prepared as to serve as a starting point for the more progressive manufacturers who believe in development work. Variety is desirable along with specification. And let the buyer put some time on the selection of a brand that will give him the best result. A trade mark implies a sort of insured uniformity of quality. It is jealously guarded and protected because it identifies a known standard of performance. If its usefulness were destroyed for the benefit of the buyer, the standard of salesmanship would certainly suffer; and it takes salesmanship to keep things moving forward in this day and age.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephone Wabash 7134

G. H. Mackenzie.....President and Treasurer
M. J. Hungerford.....Vice-President
H. S. Card.....Secretary

H. S. Card.....Editor
H. E. Saxton.....Advertising Manager

Eastern Office—222 American Circle Bldg., New York
T. E. DePew, Eastern Manager
Telephone, Columbus 6941

Cleveland Office—Hollenden Hotel
L. St. Clair Ehlbert, Cleveland Manager

Subscription payable in advance and postage free.
United States and possessions and Canada.....$3 a year
Foreign Countries.....$4 a year
Single copy, domestic.....35 cents
Single copy, foreign.....50 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

CLEVELAND—R. K. Randall, 2200 Prospect Ave.
DENVER—A. G. Odell, Public Opportunity School.
GREAT BRITAIN—Capt. D. Richardson, 30 Red Lion Square, Holborn, London, W. C. I.
AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS
Keith Dunham Company
Pressed Steel Tank Co.

AIR LIQUEFACTION OXYGEN PRODUCING PLANTS
Keith Dunham Company
Heylandt Sales Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Weldene Corporation

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec & Mfg. Co

APRONS (Asbestos)
Ideal Face Shield Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches."

BOOKS
The Welding Engineer Pub. Co.
Electric Arc Cutting & Welding Co

BRAZING OUTFITS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Alexander Milburn Co
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Williams & Co.

BRONZE FILLER RODS
American Brass Co.
Central Steel & Wire Co.
Steel Sales Corp.

BUFFERS
Mall Tool Co.
N. A. Strand & Co.
Wodack Electric Tool Corp.

BUTT WELDERS
See "Electric Resistance Welders"

CABLE (Arc Welding)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co
Wilson Welder & Metals Co.

CARBIDE
Air Reduction Sales Co.
National Carbide Co.
Shawinigan Products Corp.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Electric Arc Cutting & Welding Co.
Harris Calorific Co.
National Carbon Co.
Oxweld Acetylene Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

CAST IRON SOLDER
Weldene Corporation

CONSULTING ENGINEER
E. F. Hollinger

CUTTING ELECTRODES (Electric Arc)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Keith Dunham Company
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Wm. Wharton, Jr. Co.

DRILLS, PORTABLE ELECTRIC
Mall Tool Co.
N. A. Strand & Co.
Wodack Electric Tool Corp.

ELECTRIC ARC WELDING OUTFITS
Allan Mfg. & Welding Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
General Electric Co.
Goodman Electric Machinery Co.
Gibb Welding Machines Co.
Grindle Electric Welder Co.
Harms & Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
R. D. Thomas Co.
Una Welding and Bonding Co.
Waters Arc Welding Corp.
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRIC RESISTANCE WELDERS
Federal Machine & Welder Co.
General Electric Co.
Gibb Welding Machines Co.
Goodman Electric Machinery Co.
R. D. Thomas Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corporation
Lincoln Electric Co.
Lincoln Steel Co.
Page Steel & Wire Co.
Quasi-Arc Weldtrode Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Seneca Electric Arc Welder Co.
Stulz-Sickles Co.
R. D. Thomas Co.
Una Welding and Bonding Co.
Waters Arc Welding Corp.
Welding Service Co.
Wickwire-Spencer
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co
Gibb Welding Machines Co.
Grindle Electric Welder Co.
Harms & Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Seneca Electric Arc Welder Co.
R. D. Thomas Co.
Una Welding and Bonding Co.
Waters Arc Welding Corp.
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon Works, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

FACE SHIELDS (Arc Welding)
Allan Mfg. Co. & Welding Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
Grindle Electric Welder Co.
Harms & Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Strauss & Buegeleisen
R. D. Thomas Co.
Una Welding and Bonding Co.
Waters Arc Welding Corp.
Westinghouse Elec. & Mfg. Co
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

FILLER RODS
Air Reduction Sales Co.
American Brass Co.
Central Steel & Wire Co.
Oxweld Acetylene Co.
C. H. Hollup Corp.
Imperial Brass Mfg. Co.
Lincoln Steel Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stulz-Sickles Co.
R. D. Thomas Co.
Torchweld Equipment Co.
Wickwire-Spencer
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
Joseph Dixon Crucible Co.
National Carbon Co.
U. S. Welding Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Cortland Welding Compound Co.
Modern Engineering Co.
Momac Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Weldene Corporation
Weldit Acetylene Co.

GAS SAVING DEVICES
Harris-Calorific Co.
U. S. Welding Co.
Weldit Acetylene Co.

GLOVES (Asbestos)
Ideal Face Shield Co.

GAUGES
Moto Meter Co.
National Gauge & Equipment Co.

GENERATORS (Acetylene)
Air Reduction Sales Co.
M. Keith Dunham
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.
U. S. Welding Co.

GOGGLES
Chicago Eye Shield Co.
Ideal Face Shield Co.
Strauss & Buegeleisen
Willson Goggles, Inc.

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
Mall Tool Co.
N. A. Strand & Co.
Wodack Electric Tool Corp.

To the WELDING INDUSTRY

WE HONESTLY BELIEVE THAT

"RACO" WELDING RODS

ARE THE FINEST QUALITY RODS ON THE MARKET TODAY

WE manufacture bare electric welding rods of both Pure Iron and Mild Steel analysis. We do not recommend bare rods for electric welding. We believe that the manufacture of a good electrode only starts with a bare wire. However, as large quantities of bare electrodes are used throughout the country, we supply them to those who desire this class of material.

We believe our oxy-acetylene welding rods are the most perfect rods of this type on the American market. They are manufactured from steel and iron made expressly for the purpose. These wires are drawn and copper coated under the direct supervision of our Wire Drawing Superintendent, who has been drawing this type of wire for twenty-five years in France, Italy and Switzerland. The extremely high quality of material used and finish make it a pleasure to use "RACO" gas welding rods.

For electric welding we recommend Raco Composite Electrodes. These rods are used equally well with either A. C. or D. C. current. This rod was originally developed for automatic welding where bare wire will not function due to great speed in welding and high amperage used. The Composite Rod is recommended for all work where bare and covered electrodes have previously been used. Greatly increased speed and far better penetration is secured and absolute uniformity of rods throughout an order is absolutely guaranteed. A special flux of truly wonderful characteristics is inlaid in the lengthwise grooves the entire length of the wire. The flux is protected in the grooves and cannot chip out, even when the wire is bent flat against itself. The accurate depth of the grooves automatically regulates the correct amount of flux needed.

The Composite Wire is furnished on reels for automatic arc welding and will give perfect results under special conditions of high speed and high amperage. The flux in the grooves contains a high percentage of titanium and will weld Cast Iron with better results than any electrode on the market today.

Our Company specializes in dra wing welding wire only. We have no other inter ests and can give our welding rods our undivided attention.

Raco Welding Rods are fairly priced and we are able to give real service from our new plant at Dundalk, Maryland.

REID-AVERY COMPANY, INC.

MARSHALL E. REID, President.

Main Office:
21st and Washington Ave.
PHILADELPHIA, PA.

Works:
DUNDALK, MD.

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
Grindle Electric Welder Co.
Harms & Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Strauss & Buegeleisen
R. D. Thomas Co.
Waters Arc Welding Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

HOSE COUPLINGS
Carl A. Norgren Co.
See also under "Needle Valves"

HYDROGEN
Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Modern Engineering Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Weldit Acetylene Co.

LIGHTERS (For Gas Torches)
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Stevenson Distributing Corp.
Torchweld Equipment Co.
U. S. Welding Co.

MANIFOLDS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
Gas Products Association
International Oxygen Co.
Linde Air Products Co.

OXYGEN PRODUCTION PLANTS
Keith Dunham Company
Heylandt Sales Co.

PREHEATING DEVICES AND OVENS
Imperial Brass Mfg. Co.
Metal & Thermit Corp.

RAIL BONDS
Una Welding and Bonding Co.

RAIL JOINT WELDERS
Una Welding and Bonding Co.

REAMERS (Portable Electric)
Mall Tool Co.
N. A. Strand & Co.
Wodack Electric Tool Corp.

REGULATORS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

SEAM WELDERS
See "Electric Resistance Welders"

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

TRUCKS (Cylinder)
Air Reduction Sales Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
Torchweld Equipment Co.

VALVES
Air Reduction Sales Co.
International Oxygen Co.

WELDING COMPOUND (for Shape Welding)
Air Reduction Sales Co.
Harris Calorific Co.
Joseph Dixon Crucible Co.
Modern Engineering Co.
National Carbon Co.

WELDING ROD HOLDERS
C. Sorensen

WELDING RODS AND WIRE
See "Electrodes" and "Filler Rods"

ALPHABETICAL INDEX TO ADVERTISERS

A

Air Reduction Sales Co. ... 3
Allan Mfg. and Welding Co. ... 57
American Brass Co., The ... 45
American Welding Society ... 54
Anti-Borax Compound Co. ... 58

B

Burke Electric Co. ... 55

C

Central Steel & Wire Co. ... 19
Chicago Eye Shield Co. ... 58
Chicago Steel & Wire Co. ... 54
Commercial Acetylene Supply Co. ... 51
Cortland Welding Compound Co. ... 58

D

Dixon Crucible Co., Joseph ... 52
Dunham, Keith, Co. ... 51

E

Elec. Arc Cutting & Welding Co. ... Back Cover
Electric Welding Machine Co. ... 21
Elkon Works, Inc. ... Inside Back Cover

F

Federal Machine & Welder Co. ... 52
Fibre Metal Products Co. ...

G

Gas Products Assn. ...
General Electric Co. ... 13, 14, 15
Gibb Welding Machine Co. ... 56
Goodman Electric Mach. Co. ... 58
Grindle Electric Welder Co. ...

H

Harris Calorific ... 11
Harms & Co. ...
Heylandt Sales Co. ... 53
Hollup, C. H. ... 48

I

Ideal Face Shield Co. ... 55
Imperial Brass Mfg. Co. ... 53
International Oxygen Co. ... 56

K

K-G Welding Co. ... 54

L

Lincoln Electric Co. ... 17
Lincoln Steel Co. ...
Linde Air Products Co. ... 2

M

Mall Tool Co. ... 47
Metal and Thermit Corp. ...
Milburn, Alexander, Co. ...
Modern Engineering ... 12
Momac Sales Co. ...
Moto Meter Co. ... 16

N

National Carbon Co. ... 10
National Gauge and Equipment Co. ... 16
National Carbide Co. ... 49
Northwestern Mfg. Co. ... 52
C. A. Norgren Co. ... 47

O

Owen Electric Mfg. Co. ... 18
Oxweld Acetylene Co. ... 24

P

Page Steel & Wire Co. ... 53
Pressed Steel Tank Co. ...
Prest-O-Lite Co., Inc., The ... 4

Q

Quasi-Arc Weldtrode Co. ... 58

R

Reid-Avery Co. ... 7
Roebling, John A., Sons Co. ... 49

S

Seneca Electric Arc Welder Co. ... 50
Sorensen, C. ... 58
Shawinigan Products Corp. ... 55
Steel Sales Corp. ...
Stevenson Distributing Corp. ... 57
Strauss & Buegeleisen ... 58
Strand, N. A., & Co. ... 58
Stulz-Sickles Co. ... 59
Standard Steel & Wire Co. ... 47

T

Thomas & Co., R. D. ...
Torchweld Equipment Co. ... 48

U

Una Welding & Bonding Co. ... 50
Union Carbide Sales Co. ... 9
U. S. Welding Co. ... 11

W

Waters Arc Welding Corporation ...
Weldene Corporation ... 56
Weldit Acetylene Co. ... 57
Welding Service Co. ... 47
Westinghouse Electric & Mfg. Co. ...
Wickwire, Spencer Co. ... 22
William Wharton, Jr. & Co., Inc. ... 47
Williams & Co., Inc. ... 57
Willson Goggles, Inc. ... 56
Wilson Welder & Metals Co. ... Front Cover
Wodack Electric Tool Corporation ... 47

UNION CARBIDE

WORLD'S BEST QUALITY—HIGHEST GAS YIELD

ALWAYS PACKED IN BLUE AND GRAY DRUMS

Large Stocks of Union Carbide in all regular commercial sizes are carried at each of Union Carbide Sales Company's Warehouses listed below.

Requests for information and special correspondence should be addressed to our New York, Chicago or San Francisco offices.

Generator Sizes of Union Carbide

Packed in 100 Pound Drums

3½ in. x 2 in. (Lump)
2 in. x ½ in. (Egg)
1¼ in. x ⅜ in. (Nut)
¼ in. x 1/32 in. (Quarter)

For Oxy-Acetylene Welding and Cutting Plants, Acetylene House Lighting and Cooking Plants, Contractors' Torches and Flare Lights, and numerous other pieces of Acetylene generating apparatus designed for the use of one of these sizes of Carbide.

UNION CARBIDE SALES COMPANY

Peoples Gas Building
Chicago, Ill.

Carbide and Carbon Building
30 East 42nd St.
New York

Adam Grant Building
114 Sansome St.
San Francisco, Calif.

UNION CARBIDE SALES COMPANY'S WAREHOUSES

Shipments Always Made On Day Orders Are Received

ALABAMA
Birmingham....3329 First Ave. N.
Mobile....16 S. Commerce St.
Montgomery....
P. O. Box 621, N. Lawrence & Randolph Sts.

ARIZONA
Phoenix....42 S. Central Ave.

ARKANSAS
Ft. Smith....201 Rogers Ave.
Little Rock....1400 E. 6th St.

CALIFORNIA
Fresno....932 H St.
Los Angeles....639 Gibbon St.
Oakland....21 Madison St.
Sacramento....1717 Third St.
San Diego....301 Fourth St.
San Francisco..Adam Grant Bldg., 114 Sansome St.
Stockton....743 S. Union St.
Taft....130 Center St.

COLORADO
Denver....Nineteenth and Wazee Sts.
Grand Junction....423 South Ave.

CONNECTICUT
East Hartford....225 Prospect St.

DISTRICT OF COLUMBIA
Washington....New York and Florida Aves., N. E.

FLORIDA
Jacksonville....1008 E. Bay St., P. O. Box 473
Miami, 123 N. W. Twenty-third St., P. O. Box 290
Tampa..Ellamae Ave. and 13th St., P. O. Box 1303

GEORGIA
Atlanta....Haynes & Rhodes Sts. P. O. Box 1594
Savannah.... 725 Wheaton St. P. O. Box 78,

ILLINOIS
Chicago....132 S. Michigan Blvd.
Danville....511 Oak St.
Decatur....133 W. William St.
East St. Louis....700 Broadway
Eldorado....856 S. Fourth St.
Harrisburg....Jackson and Raymond Aves.
Marion....215 S. Granite St., P. O. Box 747
Monmouth....509 S. First St.
Peoria....100-110 Edmund St.
Quincy....313 Delaware St.
Rockford....220 Prairie St.
Springfield....1000 E. Monroe St.
Streator....501 E. Hickory St.

INDIANA
Evansville....1401 E. Illinois St.
Fort Wayne....2206 Broadway
Indianapolis....330 W. New York St.
South Bend....413 East Tutt St.
Terre Haute....641 N. Fifth St.

IOWA
Davenport....118 Harrison St.
Des Moines....Third and Elm Sts.
Dubuque....Eighth and Washington Sts.
Fort Dodge....Central Ave. at Sixteenth St.
Ottumwa....207 S. Washington St.
Sioux City....410 Court St., P. O. Box 398
Waterloo....1209 E. Fourth St.

KANSAS
Pittsburg....1201 North Broadway
Salina....154 N. Fifth St.
Wichita....600 W. Douglas Ave., P. O. Box 951

KENTUCKY
Allen....
Central City....306 Broad St.
Hazard....107 Main St.
Lexington....Third St. and Walton Ave.
Louisville....Jackson St. and River Rd.
Middlesboro....1701 Cumberland Ave.

LOUISIANA
Monroe....219 Walnut St.
New Orleans....118 N. Front St.
Shreveport....615 Market St., P. O. Box 62

MAINE
Portland....48 Commercial St.

MARYLAND
Baltimore....19 E. Lombard St.
Cumberland....18 N. George St., P. O. Box 172
Salisbury....Mill and High Sts.

MASSACHUSETTS
Cambridge....339 Concord Ave.
Indian Orchard....Pasco Road
Worcester....242 Canterbury St.

MICHIGAN
Detroit....5785 Hamilton Ave.
Grand Rapids....425-439 Ionia Ave., S. W.
Iron Mountain....513 Stephenson Ave.
Iron River....321 Carnegie Ave., P. O. Box 287
Ironwood....232 W. Ayer St.
Ishpeming....511 E. Vine St.
Jackson....518 S. Water St.
Lansing....617 E. Shiawassee St.
Muskegon....410-420 Morris Ave.
Saginaw....1630-1640 N. Michigan Ave.
Sault Ste. Marie....

MINNESOTA
Mankato....402-404 Pike St.
Minneapolis....334 N. First St.
Virginia....403 Chestnut St.

MISSISSIPPI
Vicksburg....1701-03 Levee St., P. O. Box 322

MISSOURI
Kansas City....1427 West 9th St.
St. Joseph....920 S. Sixth St.
St. Louis....(See East St. Louis, Ill.)

MONTANA
Great Falls...(P. O. Box 1138) 420 Second St. S.

NEBRASKA
Grand Island....311 West 4th St.
Omaha....1007-9-11 Jones St.

NEW JERSEY
Camden....Front and Division Sts.
Newark....251-55 Ridgewood Ave.

NEW YORK
Albany....Mill and Tivoli Sts.
Binghamton....100 Roundhouse Road
Brooklyn....1085 Grand St.
Buffalo....1345 Genesee St.
Geneva....261 Exchange St.
Jamestown....610 W. 8th St.
Kingston....O'Neil St., Near Broadway
Niagara Falls....
Poughkeepsie....Smith St. and C. N. E. R. R.
Syracuse....376 W. Water St.
Utica....135 Hotel St.
Watertown....433 Court St.
Whitehall....35 Main St.

NORTH CAROLINA
Charlotte....205 W. First St., P. O. Box 777
Greensboro....Macon & Washington Sts
Raleigh..McCulloch & Lenoir Sts., P. O. Box 149
Wilmington, 612 Surry St., Bet. Castle and Queen Sts.
Wilson....709 S. Goldsboro St., P. O. Box 516

NORTH DAKOTA
Bismark....209 Fifth St.
Fargo....414 N. P. Ave.

OHIO
Akron....97 East South St.
Athens....Corner Factory and Moore Sts.
Canton....618 Mulberry Road, S. E.
Cincinnati....67 Plum St.
Cleveland....1342 Hanna Bldg.
Columbus....330 Dublin Ave.
Dayton....104-114 S. Wayne Ave.
Gallipolis....700 First Ave.
Lima....338 E. High St.
Mansfield....131 E. Fifth St.
Steubenville....324-343 N. Seventh St.
Toledo....414 S. Erie St.
Youngstown....Jones and Brittain Sts.
Zanesville....Main and Second Sts.

OKLAHOMA
Enid....Chestnut and Adams Sts.
McAlester....31-37 East Chickasaw St.
Oklahoma City....121 E. Washington St.
West Tulsa....1402 W. 17th St.

OREGON
Portland....15th and Hoyt Sts.

PENNSYLVANIA
Allentown....311 Gordon St.
Beaver....486 Third St.
DuBois....Weber Ave. and Franklin St.
East Greensburg....Clark and George Sts.
Erie....1502 Sassafras St.
Harrisburg....25 S. Tenth St.
Hazleton....225 E. Mine St.
Johnstown....Messinger St. and B. & O. R. R.
Philadelphia....Delaware Ave. and Brown St.
Philipsburg....North Front St., P. O. Box 146
Pittsburgh....Lincoln & Taber Sts.
Pottsville....Railroad and Sanderson St.
Scranton....Penn Ave. and Vine St.
Shamokin....Fifth and Walnut Sts.
Sharon....Budd St. and South Irvine Ave.
Spangler....Bigler Ave.
Wilkes-Barre....150-156 E. Northampton St.
Williamsport....Canal and Court Sts.
York....204 N. George St.

SOUTH CAROLINA
Charleston....59 Wentworth St.
Greenville....15 E. McBee Ave.

SOUTH DAKOTA
Watertown....224 First Ave., N. W.

TENNESSEE
Chattanooga....600 E. Tenth St.
Knoxville....201-211 Randolph St.
Memphis....671 S. Main St.
Nashville....102-104-108 Broadway

TEXAS
Amarillo....101-105 Pierce St., P. O. Box 697
Beaumont....366 Liberty St.
Corpus Christi....1017-19 Tiger St.
Dallas....1118-28 Jackson St.
El Paso....317 N. Oregon St.
Fort Worth....1111 Lamar St.
Houston....812 Live Oak St.
San Antonio....Duvall and Mesquite Sts.
Sweetwater....117 E. North First St.
Waco....617 Jackson St.
Wichita Falls....1507 Lamar St., P. O. Box 1713

UTAH
Salt Lake City....103 W. Second South St.

VIRGINIA
Lynchburg....1324 Commerce St.
Norfolk....East Main & East Water Sts.
Richmond....17th and East Cary Sts.

WASHINGTON
Seattle....504 Railroad Ave., S.
Spokane....162 S. Post St.

WEST VIRGINIA
Bluefield....350 Roanoke St.
Charleston....Broad St. and K. & M. R. R.
Clarksburg....602 North Third St.
Elkins....Railroad Ave and First St.
Fairmont....Auburn St. and B. & O. R. R.
Huntington....207 Eleventh St.
Morgantown....Warren St., near University Ave.
Mount Hope....P. O. Box 416
Mullens....P. O. Box 97
Wheeling....Forty-third and McCulloch Sts.
Williamson....Foot W. Second St., P. O. Box 305

WISCONSIN
Appleton....909 N. Lawe St.
La Crosse....Front and King Sts.
Madison....513-19 Williamson St.
Marshfield....South Depot and Maple Sts.
Milwaukee....619 23rd Ave.

WYOMING
Casper....215-34 Industrial Ave.

UNION CARBIDE IS EASILY OBTAINABLE EVERYWHERE

ANNOUNCING

the Carbon Arc for special welds

FOR special welding operations and production jobs outside the fields of gas welding and the metallic arc, the Carbon Arc has particular advantages. There are certain applications where the Carbon Arc is better—there are certain types of welds where it is more applicable.

The Carbon Arc may be the solution to a difficult production problem or a troublesome construction job. Write us, describing your conditions.

National Welding Carbon Blocks and Rods for molds and cores — and Carbon Blocks and Paste for dams—are important accessories to the best welding practice.

NATIONAL CARBON COMPANY, INC.
Cleveland, Ohio San Francisco, Calif.

Unit of Union Carbide and Carbon Corporation

Emergency Service Plants

CHICAGO, ILL.
551 West Monroe St.
Phone: State 6092

PITTSBURGH, PA.
7th Floor, Arrott Power Bldg. No. 3.
Barker Place
Phone: Atlantic 3570

NEW YORK, N. Y.
357 West 36th St.
Phone: Lackawanna 8153

BIRMINGHAM, ALA.
1824 Ninth Ave., N.
Phone: Main 4016

WELDERS

LEAD BURNERS

REGULATORS

SPECIAL BURNERS

TANK VALVES

MANIFOLDS

A NEW CATALOGUE

Just Off the Press

BRIM FULL OF VALUABLE INFORMATION—
AUTOMATIC TORCHES—LINE REGULATORS
—GASAVERS—NEW DESIGN ADAPTORS, Etc.

WILL SURELY INTEREST YOU

FREE FOR THE ASKING

GASAVERS

ACETYLENE GENERATORS

"The Most Complete Line in America"

THE HARRIS CALORIFIC COMPANY

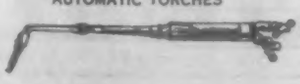
2828 Washington Ave., Cleveland, Ohio

With which is now merged the U. S. Welding Co., formerly of Minneapolis, Minn

COMPLETE OUTFITS

GENERATOR OUTFITS

AUTOMATIC TORCHES



CUTTERS

PREHEATERS

An exclusive MECO feature saves "time out" for the gas welder on busy days when time is precious

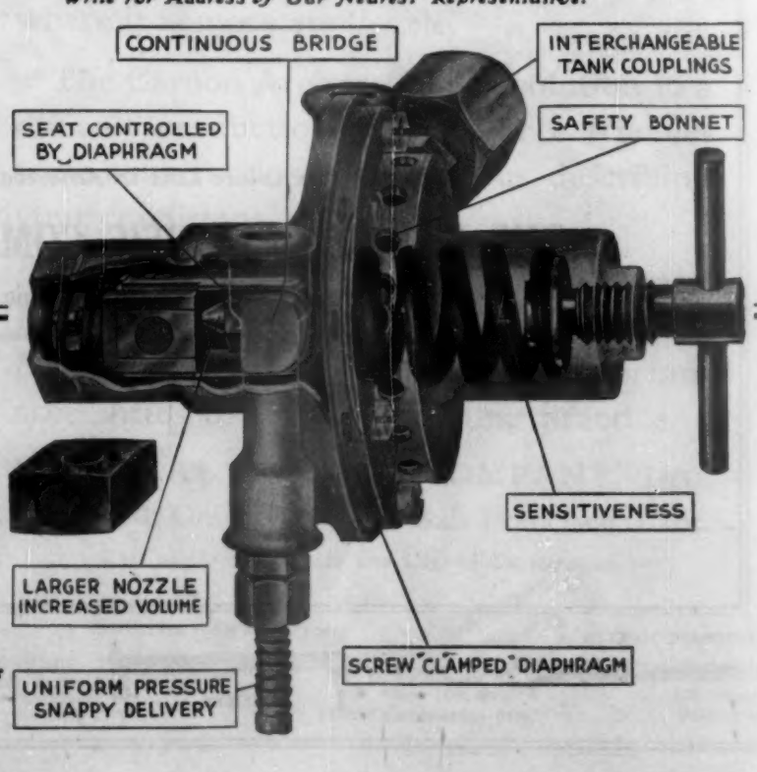
ALL MECO Regulators are of the MULTI-SEAT type; that is, they have four seats in place of one, as illustrated in the drawing below. Only one seat is in service at one time. If it finally becomes worn, you still have three brand new seats at your service. Adjust the position to place the new seat in service, and make replacements when working conditions permit.

MULTI-SEAT construction produces a regulator which lasts four times as long as one-seat regulators without the necessity of changing seats.

A trial of this regulator has caused more than one welder to standardize on MECO apparatus.

MODERN ENGINEERING CO.
3411 Pine Blvd. St. Louis, Mo.

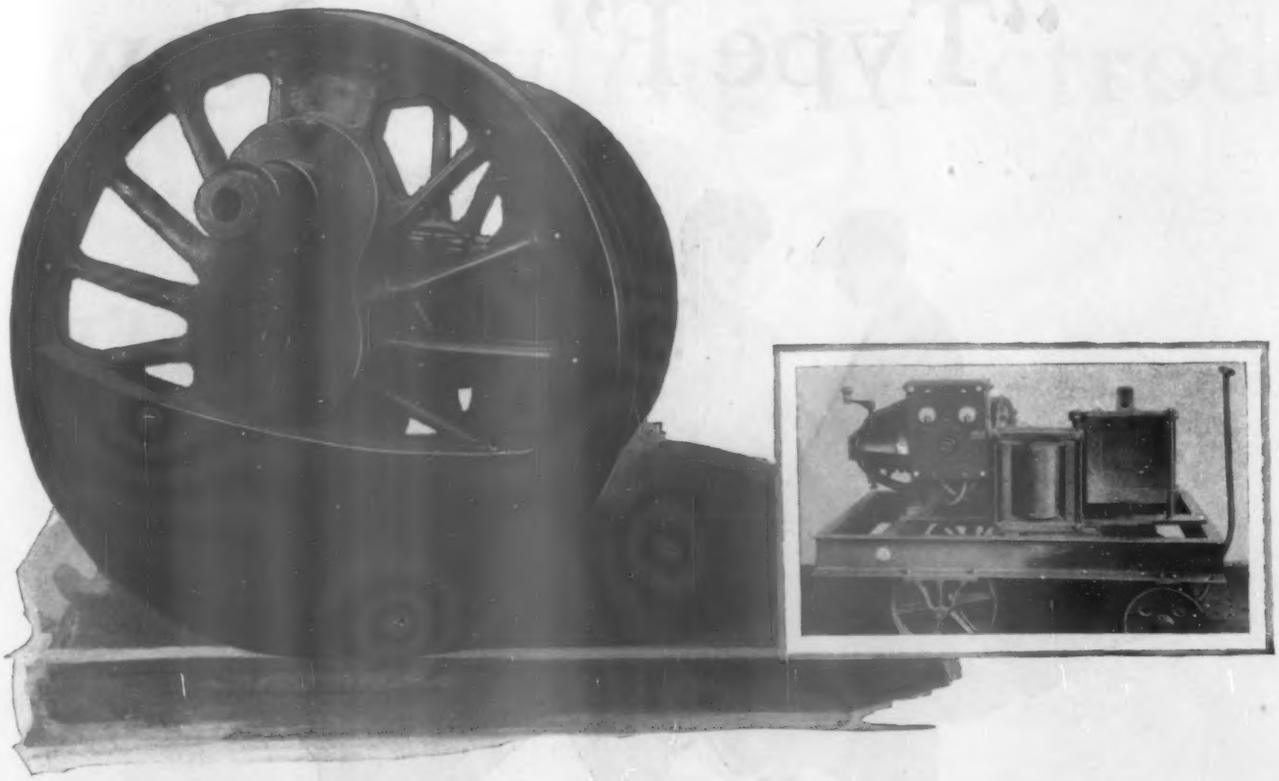
Sales and Service in All Parts of the United States. Write for Address of Our Nearest Representative.



Meco

OXY-ACETYLENE APPARATUS

Approved by the Underwriters



Rolling Out of the Hospital

Driving-wheels roll out of a large railway repair shop better than new after a simple arc-welding operation performed by G-E Arc Welders.

When the two short spokes of the driving-wheels break, the wheels are rolled into the shop. Two men and a G-E Arc Welder begin work on them. The spokes are quickly welded and in the space between them is welded a 1½-in. steel reinforcing plate.

The spokes are then stronger than when new. No locomotive driving-wheel thus repaired has ever broken in service. The complete job is done in 4 hours and very economically.

Complete details of this and other ingenious locomotive repairs performed with G-E Arc Welders will gladly be given upon request to your nearest G-E office.

General Electric furnishes to the Welding Industry:

- WD Arc Welders—designed for one operator.
- Constant Potential Sets—for several operators
- Arc Welding Resistors—for mining and traction companies
- Automatic Welders—for repetition work
- Welding Electrodes

Bulletins available at your nearest G-E office.

530-17

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

"Type F"—A New

Special Distributors for

American Steel Eng. Co.,
10 South 18th St., Philadelphia,
Pa., also 601 Granite Bldg.
Pittsburgh, Pa.

Bird-Potts Co.,
Atlanta, Ga.

Capital Electric Co.,
Salt Lake City, Utah.

Harron, Richard & McCone,
139 Townsend St.,
San Francisco, Cal.

Robert M. Hartwell,
353 East 2nd St.,
Los Angeles, Cal.

Industrial Sup. Co., Inc.,
329 East Second St.,
Los Angeles, Cal.

Hendrie & Bolthoff Mfg. &
Supply Co.,
Denver, Colo.

P. F. McDonald & Co.
17 King Terminal,
Boston, 27, Mass.

Matthews Electric Sup. Co.,
1823 First Ave.,
Birmingham, Ala.

The C. S. Mersick & Co.,
New Haven, Conn.

National Welding Equip. Co.,
223 Main Street,
San Francisco, Cal.

Root, Neal & Co.,
Buffalo, N. Y.

In absolute reliability of operation and overall efficiency, there is no superior to G-E Arc Welders. They are available in all sizes, all types—for either hand or automatic operation—for single or multiple-operator.

GENERAL

MERCHANDISE DEPARTMENT

G-E Welding Electrode

They said:

"G-E Type "B" is great for automatic work, but a little fast for hand."

"Give us a G-E Electrode with the same good features for hand work."

And Type "F" G-E Welding Electrode was developed by General Electric. It has exceptional stability—an operator using it can work longer with less fatigue. Because of less dissipation it will deposit more metal to the work.

Type "F" is a good bare electrode, chemically treated so that it has the same characteristics for hand welding, as the Type "B" fluxed electrode in Automatic Welding. Although primarily for hand work, it can be used on automatic welders. Write the distributor nearest you.

G-E Welding Electrodes

Joseph T. Ryerson & Son, Inc.,
Chicago, Ill., also
Cincinnati, O., Detroit, Mich.,
St. Louis, Mo.

Seattle Hardware Co.,
Seattle, Wash.

Southern Electric Co.,
Baltimore, Md., also
Charlotte, N. C.
Norfolk, Va., Richmond, Va.

Southwest General Elec. Co.,
Dallas, Texas., also
Houston, Texas.
Oklahoma City, Okla.

Strong, Carlisle & Hammond Co.,
Cleveland, Ohio.

Union Iron Works,
Spokane, Wash.

Virginian Electric Inc.,
Charleston, W. Va.

A. J. Wilson Co., Inc.,
120 Liberty St.,
New York, N. Y.

W. A. Ramsey, Ltd.,
74 Queen St.,
Honolulu, Hawaii.

Oliver H. Van Horn Co., Inc.
522-534 Camp Street,
New Orleans, La.

Welding Service Co.,
50 Church Street,
New York, N. Y.

TYPE A
recommended for cast iron.

TYPE B
for steel.

TYPE F
for general welding.

550-11

ELECTRIC

BRIDGEPORT, CONNECTICUT

The Boxer
A Bronze found in Ancient Rome

Built of enduring Bronze

The "Natweld" Bronze Bourdon Spring for high pressure oxygen service is accurate.

Accurate when new because it is properly designed and made by men who know the secrets of fine bronze spring making.

Accurate throughout its long life because the "Natweld" process of spring treatment prevents "setting."

"Natweld" Gauges cost no more —for big production and volume sales together have brought prices down.

The Moto Meter Company, Inc.
Wilbur Avenue, Long Island City, N. Y.

National Gauge & Equipment Div., La Crosse, Wisc.
Chicago Office—820 Tower Court
The Moto Meter Co. of Canada, Ltd., Hamilton, Ont.

NATWELD

GAUGES

Pop is penny-wise

"Listen, Lad...

I've been gumshoeing around looking for leaks and I've found a good one. I see that you've been paying too much for welding rods. I have a friend who can sell me welding rod at a nice saving."

Kathode wire is furnished in the following diameters:
3/32", 1/8", 5/32", 3/16", 1/4", 5/16", 3/8".

Lincoln Shields are absolutely leak-proof.

Here is a holder that will save many minutes of the operator's time. It is a simple, powerful clamp in which the electrode is firmly held.

"Sure, Pop...

and I can pull down the wire fence around the plant and make a still greater saving by using that wire. "Here's why we're using the wire that we're going to continue to use:

"One day I got this note from one of the welder men reading:

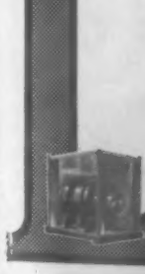
> 'I ran across some Kathode Welding Rod that came with the new Lincoln machine. It sure is wonderful welding rod for all my work. If every factory would leave the choice of welding rod to the operator, they'd all be using Kathode Rod and getting a higher grade of work. I, for one, can't do good work with any old cheap rod.'

"That's why I bought Kathode, pop, and if we don't continue with it, we insult the experience of the very men who profit from an easy flowing rod that makes a good weld.

"'Best Welder—Best Rod—Best Operators' is my motto, pop."

The Lincoln Electric Co. Dept. No. 27-3
Cleveland, Ohio

W.F.-4



"Stable Arc"
LINCOLN WELDER

For Efficiency

the

OWEN INDUCTION ARC WELDER

is unexcelled

Easy to operate, no moving parts, no complicated mechanism.

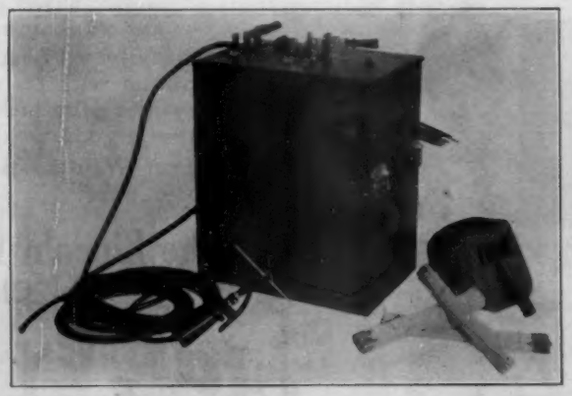
Light Weight—*Very Portable.*

FOOL PROOF

Welds cast iron, malleable iron and all classes of steel, giving a deep penetrating, smooth, even flowing *Arc.*

Have been used by manufacturers, machine shops, boiler works and garages for over two years.

We guarantee our apparatus to produce results as claimed.



Bare or Coated Electrodes

Owen Electric Manufacturing Company

Fayetteville, North Carolina

SWEDOX

WELDING RODS, WIRES and ELECTRODES

SWEDOX Welding Rods and Wires, differing widely in chemical and physical properties, have one common quality. Each brand is made for a particular welding requirement.

When you consider the care that must be exercised in the selection of metal for different construction requirements, it becomes apparent that equal care is necessary in selecting filler material for welding the joints in these constructions.

The SWEDOX line has been developed so as to furnish on each welding job the welding wire which will enable the welder to get the most satisfactory result. There is a SWEDOX wire for your work. Try it, and you'll know why SWEDOX customers come back.

Central Steel & Wire Company

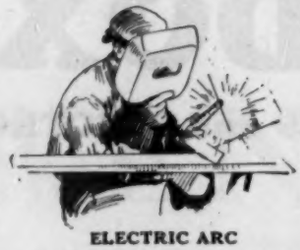
CHICAGO, ILL.
4545 S. Western Blvd.
Lafayette 8500

DETROIT, MICH.
5001 Bellevue Ave.
Lincoln 6780

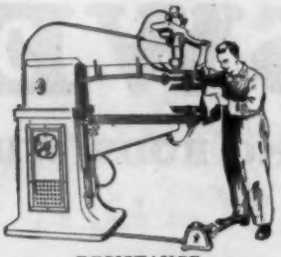
Main Warehouses and General Offices, Central Steel & Wire Co., Chicago.

No matter what kind of welding you do--

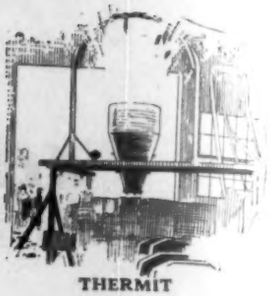
OXY-ACETYLENE



ELECTRIC ARC



RESISTANCE



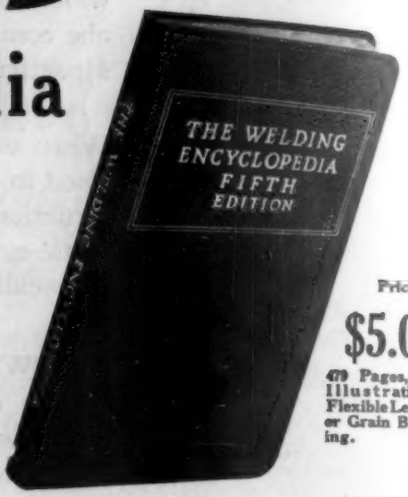
THERMIT

If you Weld, you need this book

The Welding Encyclopedia

Fifth Edition

It describes in detail the theory and practice of every welding process. It tells how to weld every weldable metal by each of the welding processes. It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. It tells how to prepare parts for welding. It tells how to install and care for welding equipment. It explains the meaning of all words and terms found in welding literature. It tells where to buy all standard makes of welding apparatus and supplies.



Price

$5.00

479 Pages, 625 Illustrations. Flexible Leather Grain Binding.

Contents

1. Illustrated encyclopedia covering all words, terms, and trade names used in welding.
2. Oxy-Acetylene Welding.—Aluminum, Steel, Cast Iron, Brass, Bronze. (Full instructions for welding each of these metals.)
3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
4. Electric Resistance Welding.—Includes Butt Welding, Line Welding, Percussion Welding and Spot Welding.
5. Thermit Welding.—The most complete treatise on this process ever published.
6. Cutting Metals.—Treatises on both gas and arc cutting. Includes cast iron cutting and automatic cutting.
7. Boiler Welding.—Gas and Electric Processes. Suggestions, procedure, and standards of practice.
8. Complete chapters on Pipe Welding, Rail Joint Welding and Tank Welding, explaining procedure in detail.
9. Rules and Regulations.—What can be welded and what cannot be welded. Rules also govern the installation and operation of equipment.
10. Complete instruction courses in Electric Arc Welding and Oxy-Acetylene Welding. Lessons, Exercises, Reference Readings, Examinations.
11. Charts and Tables.—A fund of welding information at a glance. Includes color chart showing colors at various temperatures, and color chart showing proper adjustment of oxy-acetylene welding flame.
12. Condensed Catalogs.—Up-to-date information about the leading makes of welding apparatus and supplies. The Buyers' Index is a convenient and reliable guide to the man who purchases or recommends welding apparatus.

The Welding Encyclopedia is Used by:

Welding Shops	Lumber Companies
Garages	Ice Plants
Boiler Shops	Power Plants
Round Houses	Auto Body Works
Car Shops	Ornamental Iron Works
Scrap Yards	Sheet Metal Shops
Refineries	Shipyards
Auto Factories	Gas Plants
Tank Builders	Foundries
Street Railways	Machine Shops
Airplane Factories	Pipe Line Companies
Steel Mills	Industrial Plants

THE WELDING ENGINEER PUBLISHING CO.,
608 S. DEARBORN ST., CHICAGO, ILL.

Please send me a copy of The Welding Encyclopedia, Fifth Edition, for which find enclosed five dollars. I understand that I may keep it for five days for examination and if it is not satisfactory I may return it and you will refund the purchase price.

Name _____

Street _____

Postoffice _____

Do All of Your Arc Welding With

The New

"WELDRITE"

TRADE MARK REG.

ELECTRIC WELDING MACHINE

BECAUSE

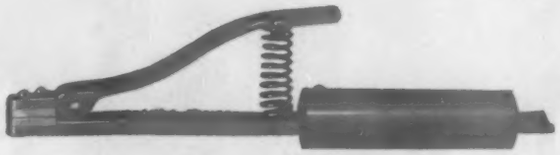
The new "Weldrite" has the correct range of heat for all classes of work, due to the Intermittent as well as the continuous arc as developed by these machines.

Eighteen different heat controls make this possible.

Cast iron, chilled iron, steel and malleable are being welded by hundreds of satisfied customers all over the country.

Flat, vertical and overhead welding is successfully performed, with the least effort.

Accept a demonstration of the "Weldrite" and you will immediately appreciate the superiority of this machine.



THE NEW

"WELDRITE" ELECTRODE HOLDER

Here are some of the Feature Points of the

"WELDRITE" Holder

(1) **Bulldog grip, removable jaws,** easily replaced.
(2) **Special heat resisting alloy metal.**
(3) **Special treated spring** retaining the necessary spring properties indefinitely.
(4) **Insulation bushings,** preventing any heating of spring.
(5) **Extra heavy fibre handle,** well ventilated. Light, durable and strong.
(6) **Cable connection of special design,** eliminating any soldering.

Fill out and mail this coupon today.

We are interested in handling the "Weldrite" in the territory noted below and would like you to submit your proposition to us.

Name .....

Address .....

City .....

Territory wanted .....

THE ELECTRIC WELDING MACHINE CO.

1530 E. Larned St. Detroit, Mich.

Canadian Plant: Walkerville, Ont.

Why WISSCO WIRE *Excels*

WISSCO welding wire is of the quality you would naturally expect in the product of the leading wire specialists since 1820. It is the special processed welding wire.

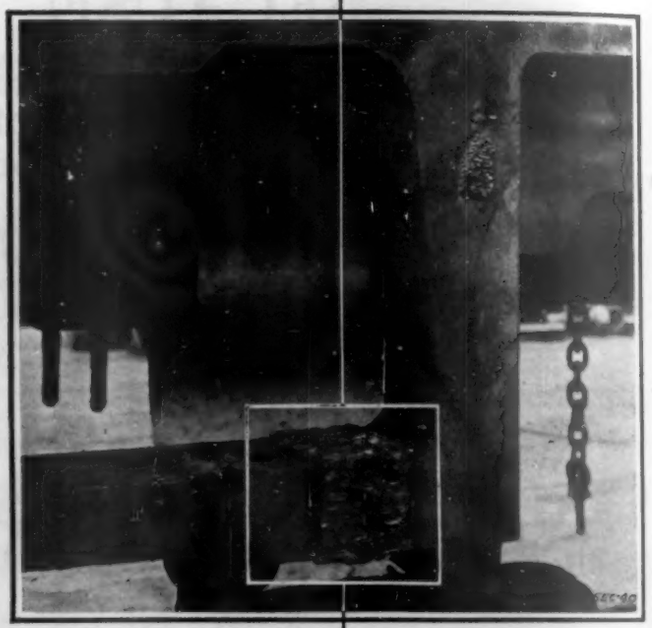
THROUGH every detail of manufacture, from mining of ore to making of finished wire — all of which processes are under our direct and sole control—we keep foremost in mind the particular type of work for which the wire is being developed.

EACH grade is composed of special analysis, specially processed wire produced for a certain type of welding.

ALL WISSCO welding wire is tested for chemical, physical and welding properties before being passed. Uniformity and proved welding ability are thereby insured.

Wickwire Spencer Steel Company
41 East Forty-Second Street
New York City

USE OF WISSCO welding wire insures sound, permanent weld, and fulfills its purpose completely—unfailingly.



WISSCO GRADE NO. 2 SPECIAL. PROCESSED ELECTRODES.

Developed for particular consumers; i. e. Railroads, Shipyards, Boiler Makers, etc. for use on general repair work.

Samples on Request

FOR FURTHER INFORMATION—Use This Coupon

Wickwire Spencer Steel Co.,
Dept. 3-WE, 41 East 42nd St., New York City.
Please send me your booklet "Wisco Welding Wire".

Name .....

Address .....

WICKWIRE SPENCER PRODUCTS

EDITORIAL

The Inspired Reporter

FOR real comedy give us a newspaper reporter writing on subjects pertaining to any branch of the welding industry. We have seen some wonderful accounts of the accomplishments of welding, some highly interesting accounts of acetylene explosions where there was no acetylene, and can recall a particularly delicious scientific explanation of why hydrogen was used to fill some balloons for a balloon race. The choicest morsel of all is one which describes a motion picture film. The reporter tells the general public in all seriousness that a gold lens was used in taking the pictures. His conception of the rest of the program was quite on a par with this highly interesting statement. It is quite natural for the welding industry to court news paper publicity. It deserves publicity because it has real news value, but nobody in the industry wants to be blamed for fantastic statements or to be misquoted on technical subjects. It is a good idea to arrange for some publicity where local organizations are giving time to a discussion of welding subjects. To be on the safe side, however, it is suggested that speakers write out in advance an interview with the local newspaper reporters and try to have these prepared reports published instead of leaving it to the reporter to supply the ideas. These young men are doing the best they can, and will undoubtedly be willing to take credit for an accurate and sensible report of such events.

The Man Behind the Weld

AS TIME goes on there seems to be less fear expressed of the human element in welding. Wherever welding is being used there is a general tendency to have the operation more carefully supervised. When good supervision exerts its influence the human element does not seem to be a source of worry. Automatic machinery is being developed in every branch of welding, and is serving to take care of a lot of troubles which formerly were caused by unskilled operators. But even the most highly developed automatic machinery for welding requires some personal attention. The man in control of it needs to know what the machinehy is expected to do and how he can tell when the job is not being done right. The operator is the man who controls the work, whether it is all hand work or all machine work. Whether he gets the work done to the best advantage or not will usually depend upon how much he is encouraged to exercise that control in the interest of the desired result. Operators may be easy to get but that doesn't furnish any excuse for careless picking. New fields are opening up for welding. Get good men to work them, men who can make good welds. It is the quickest way to develop the industry.

The Business Outlook

A BETTER year than ever before seems almost inevitable. Business is in good condition in every respect, with no disturbing elements in sight. For manufacturers of welding equipment this condition should persist, because of the undeveloped markets. The markets have to be made. The work of making them will be paid for in the relieving of competition in present markets. The salesman who looks for business from firms who are not at present using welding to any extent have the right idea. Their business outlook is the best. So is their territory.

A Program Worth Watching

THE research planned by the American Welding Society on structural work is paving the way for rapid progress in a field of application which is a fast growing one. The organizations working to extend the use of steel are among the strongest and most energetic of American commercial associations. These organizations are friendly to the welding idea because it promises economies and improvements. But they want to know. And we intend to tell them. For example, information is wanted on the strength of welds. So the welds themselves will be broken, and data will be collected to show whether it is always necessary to weld the full length of a seam or joint, how large a safety factor can be figured in welded design. It is expected that many restrictions on welding will be removed as a result of this research, and many engineers won over to the process. The project is of direct interest to every member of the industry.

The Indispensable Torch

WHEN fast quantity production is the rule in any factory the welding torch may become a vital necessity at any moment. A machine turning out thousands of the same article every day is counted upon to beat competition. The owner cannot afford to have it go suddenly idle in the midst of a busy season. Hours, even minutes, may be precious. A welding torch, ready for action when any metal part gets damaged, will save many times its cost by shortening a single period of delay. It is as necessary as a fire extinguisher on this count alone. But it is better than a fire extinguisher because it has a thousand and one uses independent of accidents and breakdowns. Put a real welder, who knows his stuff, in any plant for six months and he'll get the reputation of being the indispensable handy man.

Selling the Process

A MANUFACTURER of steel buildings informs his associates that his product is his best salesman, because people who see his buildings come to him for duplicates. That's what should be the case with welding. Welded jobs should be done with such care that they attract attention, and make men who haven't considered welding go out and buy apparatus, so they can make their stuff as well as the other fellow does. Welded products should always be better products, no matter whether they are cheaper or not. When the word "welding" is linked up properly with "quality," the quality of welded joints will cease to be questioned.

Willing to Weld

WORK done in the heating and ventilating field on a small scale by some few men interested in welding has stirred up a desire in that field for more complete knowledge. Association men and engineers in the heating and ventilating industry as well as the plumbing industry are calling for information which will enable them to judge how much use they can make of welding. They are conscious that welding has marked advantages and that the information available to them so far has been of a general nature. Whatever can be gathered together for their benefit and delivered to them is pretty sure to be widely circulated. This is one of several markets in the very early stages of development. If properly cultivated it is certain to yield a harvest of orders for welding equipment and supplies.

Make Plans for the Detroit Meeting Now

FORMAL announcement has been received of the Fall Meeting of the American Welding Society. Arrangements have been made definitely to hold the International Welding and Cutting Exposition at Detroit, coincident with the meeting and in cooperation with the American Society for Steel Treating. The welding processes are so definitely in accord with the subject of heat treating in their promise to secure both progress and economies in the metal working industry that the proposed combination of effort looks like a splendid move. It is certain that welding will be brought to the attention of many industrial executives whom industry desires to reach. Therefore, from both commercial and educational viewpoints, it is desirable to make the best possible showing of all of the welding processes and their possibilities. Every manufacturer in the industry ought to be represented with a carefully arranged exhibit.

"Operator, please call Oxweld"

RIGHT at the end of the telephone. No matter where you live—Seattle, New Orleans, Atlanta or Boston—your telephone operator can call an Oxweld office.

Oxweld factories, sales offices and apparatus repair stations are spotted all over the country in every important industrial center.

Stocks of Oxweld generators, blowpipes, regulators and welding rods are carried at convenient points for prompt delivery. And Oxweld apparatus service men are everywhere.

Naturally such a development has not been spasmodic but steady and progressive. Naturally, too, it has been built on the confidence of Oxweld's customers in Oxweld equipment and service. For no such extensive growth is possible unless the product is worthy.

OXWELD ACETYLENE COMPANY

Unit of Union Carbide and Carbon Corporation

CHICAGO
3642 Jasper Place

LONG ISLAND CITY, N. Y.
Thompson Ave. and Orton Street

SAN FRANCISCO
1050 Mission Street

STOCKS IN 39 CITIES

Welding Reduces Power House Costs

Lower Building, Operating and Maintainance Charges are Insured by Its Use at N. Y. Edison East River Station

By T. Eugene De Pew

GREATER economy in power generation is the objective in the building of modern generating plants and to this end all thoughts and energies are bent. Outstanding in economy of operation is the new East River Generating Station of the New York Edison Company, at Fourteenth Street and East River, New York City, which was designed by Thomas E. Murray, Inc., in association with the engineers of the New York Edison Co. Initial low building cost, small maintenance charges and moderate operating costs are greatly aided by welding, which was largely done by the Hutton Welding Co., Jersey City, New Jersey.

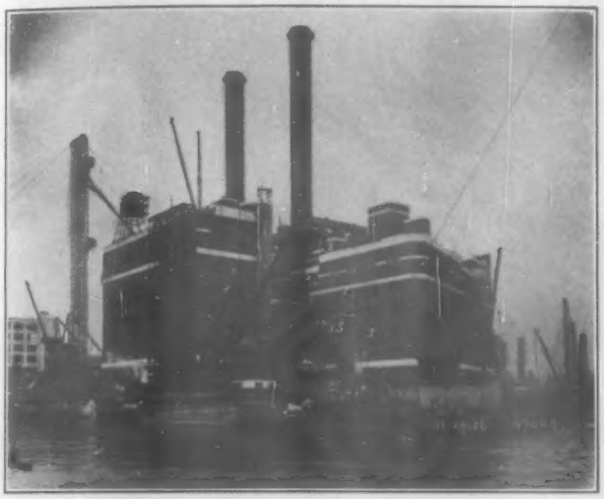


Fig.1 —Station Viewed From East River.

Fig. 2a—View of Stack Interior.

A long stride toward economy in operation—the use of pulverized coal for fuel—was made feasible by use of welding. Low maintenance costs of such important parts as the smoke stacks was insured by welding. Numerous other ways in which welding was of service are enumerated below.

The new station supplies 25 cycle current at 11,400 volts to the New York system and 60 cycle current at

Fig. 2—Welded Stack, at Base of Which is Grouped the Welding Crew.

Fig. 3—Welding Clips to Water Tubes of Boiler.

13,800 volts, to the United Electric Light and Power Co. The plant proper, when completed, will in its entirety occupy an area approximately 1092 by 206 feet. Following excavating for foundations of the building piles were driven and upon them placed a reinforced concrete mat, and upon the foundation mat, in turn, were placed the grillages for carrying the

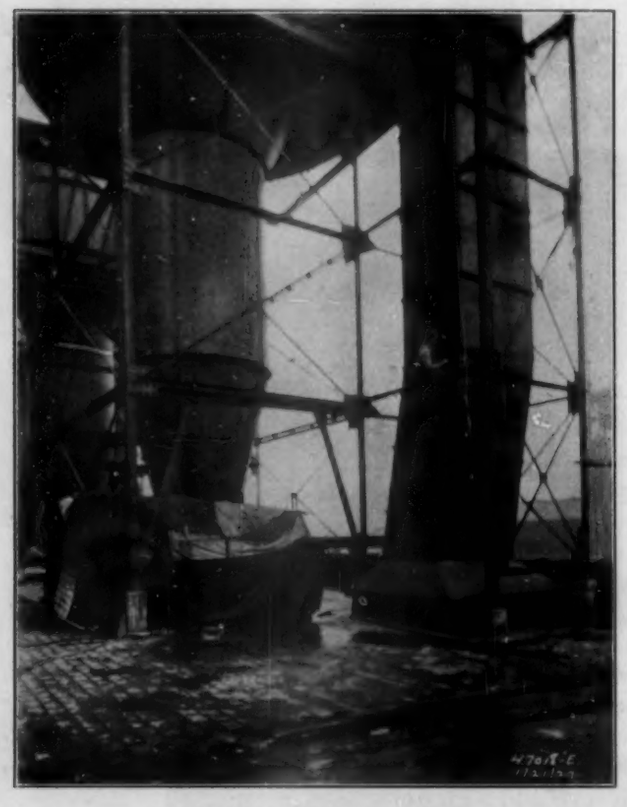


Fig. 4—Welding the Induced Draft Flue.

structural steel. Construction of building is of steel with self-supporting exterior walls and self-supporting unlined stacks 22 feet in diameter. (See Fig. 2.)

The tops of stacks are 376½ feet above the basement floor, mounted on heavy girders at the roof level, and the stacks tower to a height of 256 feet above the roof level. At present there are two stacks but upon completition of the entire building there will be seven stacks in all.

Each of the two stacks required 8,000 feet of welding. Following fabricating of the stacks by riveting, in order to insure much longer life, all seams were completely closed by welding (using Wilson No. 17 wire) on the inside, thus forestalling the corrosion

Fig. 5—Welding Over Rivet Heads in Cinder Catcher.

that would occur were acid deposits from fumes allowed to collect in seams, corrode and eat away the metal. In this welding Wilson machines were used and 150 amperes were employed.

There are six boilers to each stack. The boilers, while in general of standard Springfield design, differ in the respect that one 4-inch tube with fins takes the place of four 3-inch tubes in the outside sections of the upper bank, and these 4-inch tubes, comprising the outer row of tubes above the superheater have vertical fins welded to them which form a metal fire on the furnace side and so designed that no refractories are necessary. To prevent external radiation, two inches of diatomaceous earth bonded with cement is placed next to the fins and fills the spaces between the water tubes, while outside of this material is placed four inches of cement reinforced with

Fig. 4a—Welding in Interior of Induced Draft Flue.

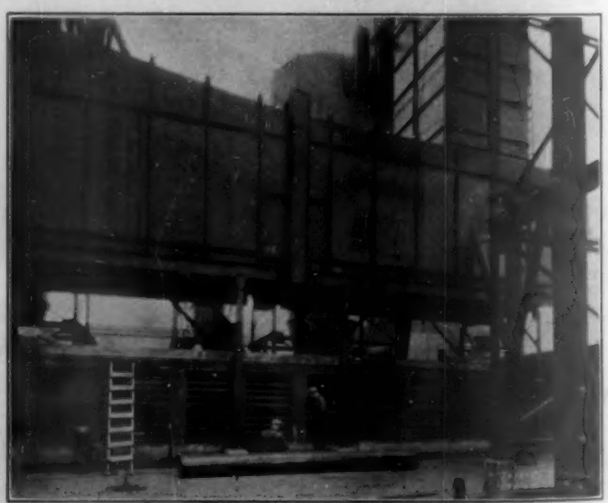


Fig. 6—Horizontal Flue Between Stacks.

one-eighth inch rods welded to clips attached to the tubes, as shown in Figure 3. The clips are placed eighteen inches apart, on every other tube; the tubes are a trifle less than 33 feet high.

The fuel for furnace, pulverized coal, is sent from grinders in mill house, which is connected with generating station, and forced by an air pressure through transporting pipes across the connecting bridge into individual bins of the boiler house, located above each boiler, from where it is picked up by feeders and with compressed air the current of powdered fuel is forced into the furnace through the burners.

The boilers, because of improvements, can produce 250,000 pounds of steam per hour or 500 percent of ordinary commercial rating of approximately 50,000 pounds. Total steam temperature is 700 degrees Fahrenheit.

Preheaters supply hot air to furnace for combustion, the hot air being injected with powdered coal. Draft requirements are provided by means of forced draft through the air preheaters and induced draft to the stack. In figure 4, is pictured the welding of the wall. The weight of the rear wall of furnace is carried directly from the upper boiler header sections, while the front wall is suspended from steel work, as are the two side walls. The upper header of the flat arch construction is carried on steel work and as this point is fixed while the main boiler expands downward it is necessary to provide a seal at this point.

The steel plate enclosure is made by welding a thin plate to both the mud drum and the upper header of the flat arch. This is arranged in such a way as to take care of expansion. Directly in front of these headers a tile partition is installed to prevent the radiant heat of the furnace from striking the headers. The same method of sealing has been adopted at the base of all walls.

To reduce cost of furnace maintenance and increase steam producing capacity of boilers a completely water-cooled boiler furnace wall, designed by Thomas E. Murray, senior vice-president of the New York Edison Company, is used to eliminate use of fire brick and refractories with their attendant rapid deterioration and high repair costs. The wall surface is formed by Murray type fin tubes, completely exposed to the induced draft flue, extending from induced draft fan to smoke stack; all seams were welded. In Figure 4a is shown the welding of part of induced draft flue extending from induced draft fan to cinder catcher.

The welding of the cinder catcher, or wet-washer, is illustrated in Figure 5. In addition to welding the seams with Wilson wire No. 9, at 145 amperes, and welding doubling plate with No. 0 wire, it was considered necessary to weld over all rivet-heads, to prevent the heads being eaten off by acids deposited by the fumes. The flue gases are washed in this cinder catcher, or wet-washer, and then passed through enormous centrifugal Cyclones which catch the fine dust before the flue gases are finally delivered to the towering stacks.

The horizontal flues shown in Figure 6, which extend between stacks, have all seams welded.

Use of pulverized coal necessitated welding of the coal hoppers, which have dimensions of 27′-5″ length by 28′-1½″ by 9′-11″ width. All seams and angle irons were welded flush.

Following completion of all welding, it was estimated that average weight of metal deposited per man was 15 pounds in eight hours.

WELDED RAIL BONDS

By W. P. Bovard, in "Railway Signaling"

The evolution in methods of bonding track rail which has taken place during the past several years has had marked influence on railway operation. Beginning in the year 1914 with oxy-acetylene welding of copper rail bonds on one of the smaller railroad electrifications, the process of welding has seen adoption on many of the important electrifications. It is widely used for track circuit bonding in automatic block signal service and several installations are in use for automatic train control.

Both oxy-acetylene welding and the electric arc are extensively used in the electric railway field for bonding track.

Where only a few years ago the railway electrification engineer went ahead rather boldly and in the face of criticism to apply welded bonds, he now finds it necessary to refer only to numerous installations under widely varying conditions for proved service and economies.

The Boston & Maine has adopted gas-weld bonds for maintenance in their Hoosac tunnel electrification at North Adams, Mass. This is an 11,000-volt single phase installation and No. 4/0 capacity bonds on both rails prove ample for track return.

The initial installation of gas-weld bonds was made on new rail which was bolted and bonded before being thrown into place in long lengths, without traffic interference.

When the Baltimore & Ohio decided to electrify its extensive transit property on Staten Island, N. Y., the company used gas-weld bonding. Rail in this case is 100-lb., with 4-bolt heavily beaded angle bars. With 600-volt propulsion, heavy currents were required to handle long trains of multiple unit passenger equipment.

A special 250,000 c.m. 13½ in. length gas-weld bond was adopted, placing two bonds per joint. By this method, a total return capacity of 1,000,000 c.m. per track is secured. For special work bonding, a single 500,000 c.m. gas-weld bond was used. The jumper bonds were applied in every case to the rail head.

The Chicago, Milwaukee & St. Paul has applied gas-weld rail bonds on its extensive 3000-volt d-c. electrification since 1921 on practically all new rail and for maintenance. This bond, of No. 4/0 capacity, 7 in. long, shown in Fig. 3, replaced a 37 in. length, 250,000 c.m. bond having ⅞ in. diameter pin expanded terminals. The gas-weld bond is installed for about one-half the cost of the previous method. Sufficient proof of comparative efficiencies lies in the fact that the No. 4/0—7 in. gas welded bond replaced two 250,000 c.m. bonds in heavy load territory with a better return circuit provided and overcame serious signal troubles.

The foregoing are a few examples of the extensive application of gas-weld bonds. Among the results secured by this method are: Uniformly constant track resistance with resultant stabilized voltage conditions; uniform low resistance track circuits for signaling with danger of unbalanced circuits minimized; a bond which can be readily inspected for mechanical and electrical conditions; and maintenance features tried out and proven practical.

WELDING LOCOMOTIVE DRIVERS ON TRACK

By A. W. Young

This requires the construction of special heating apparatus and is intended to be used in Railroad back shops. The appliance would consist of 3-inch pipe, 4 feet long, welded to heavy base to be secure in upright position. Holes to be cut at the bottom of pipe and nipples welded in to attach air pressure and coal oil hose. Up side of pipe seven holes cut and nipples welded in for hose connection to the blowers. It would be best to stand this six feet away from driver to be well out of the road of operation. We next require supports for the blowers that would place them at any height required. This would consist of 2-inch pipe, 6 feet long, welded to heavy base. Upon the pipe, sliding spools with thumb screws to set at any point. Weld to each of the spools a piece of ¼-inch sheet metal, 5 inches wide, bent up in the form of a hook upon which the blowers are laid. Loosen the tire in the regular way and take off. V out the broken spoke with cutting torch and chip clean. Take care not to cut through spoke; leave ¼ inch at the bottom, which can be taken care of as last operation. By doing this you will avoid an immense contraction. Take fire box brick and build up on edge back of driver; this will hold the heat. Set blower support stand close to driver, so blowers will play on cracked spoke. Two spokes on each side of same and the rim on each side. Do not set blowers on a straight line across driver, but in a curve outward on both sides of spoke to be welded, which will give you more expansion to rim in line with spoke to be welded. See that the spoke is a little above horizontal, as it is hardly advisable to heat the bottom of wheel that is carrying the weight. It will not be necessary to heat driver red hot, it will gain enough expansion before that high a heat. After everything is ready turn off blower on broken spoke and proceed with the weld, then cut out on under side of spoke and weld. Allow the blowers to play on driver 15 minutes after weld is completed. By that time the extra heat at weld will have died down so the whole area heated may start to cool at fairly even temperature. Some may think this quite an elaborate preparation but once having the appliance it is good for a long time, and when you consider what it means to disconnect drivers, take to hydraulic to remove wheel and put on a new one and connect up again, in addition to tying up a locomotive that might have made earnings, it will prove a money saver.

GOOD ATTENDANCE AT RAILWAY APPLIANCES SHOW

The following firms manufacturing equipment for welding were exhibitors at the Railway Appliances show, at the Coliseum, Chicago, March 7-10; General Electric Co., Air Reduction Sales Co., Torchweld Equipment Co., Carbic Mfg. Co., Euclid Electric & Mfg. Co., Oxweld Railroad Service Co., Metal & Thermit Corporation, Westinghouse Electric & Mfg. Co., Page Steel & Wire Co. The show was well attended and a number of exhibits of welded products were noticed.

NEW G-E PORTABLE WELDER

A new General Electric portable arc welding unit was exhibited for the first time at the Railway Appliances show in the Coliseum, Chicago, during the week of March 7. It consists of a G-E welding generator mounted on a Fordson tractor, equipped with Pontiac under frame and Cahl Track tread. The portable outfit is planned especially for track work, such as manganese crossings, worn rail ends and bonding. An electric hammer and electric grinder are supplied with the machine. The motor is forty horse-power and will operate the welder a thousand feet from the work.

MASTER BOILER MAKERS' CONVENTION

The Master Boiler Makers' Convention will be held at the Sherman Hotel, Chicago, May 3rd, 4th, 5th and 6th, 1927

This convention will be attended by all of the prominent Railroad Master Boiler Makers, Foreman Boiler Makers, and a large number of Master Mechanics and higher mechanical officers.

The meetings of the Boiler Makers are to be held on the Mezzanine floor, and exhibits will be placed in the large new Exhibit Hall on this floor. This is by far the largest and most convenient exhibit space the association has ever had and should be unusually satisfactory in every way.

WELDING RODS FORM SUBJECT OF CHICAGO MEETING

At the regular meeting of the American Welding Society, Chicago Section, which was held Friday evening, March 4th, Mr. J. J. Crowe of the Air Reduction Sales Company, New York, read a paper on the subject of welding rods. This paper first outlined the history of the oxy-acetylene process and the different devices and materials used in applying it. Mr. Crowe then took the welding rod as one of the materials used in the process and showed why the rod used must have other known characteristics besides chemical composition and correct dimension. He explained why the method of making the steel from which the rod is drawn has an effect upon its welding quality, then after pointing out the effects secured by the addition of certain impurities, he outlined the control methods necessary to make sure that the welding rod delivered to the customer would be of the required quality.

The meeting was well attended, and following Mr. Crowe's paper there was a lively discussion of the subject of welding rods and welding rod specifications. Then a motion picture was shown of the oxy-acetylene welding operations on locomotive work.

THE WESTINGHOUSE ADVERTISING POLICY

Much misunderstanding has developed over the recent newspaper stories concerning the announcement on the part of the Westinghouse & Electric Manufacturing Company to use daily newspaper advertising. Certain newspapers used the news story that was sent out in such a way as to make it appear that no other media might be used.

The Westinghouse company is giving up all general magazine advertising, feeling that it can handle institutional advertising and certain product advertising through concentration in localities as conditions demand. The newspaper space will not be used for highly technical apparatus, but primarily for apparatus that is sold through dealers and jobbers. For instance, it might run a campaign on street lighting in a certain city where it was known that thought is being given to a new street lighting system. It was felt that such a situation is primarily of local interest, and that in this, as in many phases of the company's general advertising, newspapers furnish a more effective medium than do general magazines. Trade and technical publications will be used as before.

WELDING BRAKE BEAMS TO MAKE GOOD AS NEW

Brake beams on all types of cars become worn at points where the pull rods are attached. The practice of the Grand Rapids Railway, Grand Rapids, Mich., is to build up the worn surfaces, fill in the holes and when redrilled the beams are as good as new.

Some of these are found to be worn to a depth of ⅜ in. The welding work is done with an oxy-acetylene outfit and a welder can build up and fill in the holes of a brake beam in half an hour. This method of repair has proved effective in reducing noise.—Electric Railway Journal.

Pipe Welding Under Difficulties

Welded Joint Chosen as Best for High Pressure Line—Pipes Connected Outdoors in Midwinter—Line Tests Free of Leaks

By George Walker

SOMETIMES the question of welding in cold or stormy weather comes up when welded joints are being compared with other types of joints. People who do not know all about the welding process seem to think that the welder must sit down and wait for ideal weather conditions. Any old-time welder knows better, particularly if he has ever done any outdoor welding. The following story describes a high pressure steam pipe line which was welded under extremely severe winter weather conditions. The success of this job certainly proves that good welders are not fair weather birds. We like to have atmospheric conditions as pleasant and agreeable as possible, but on the whole we take our work as we find it and our welded lines are the strongest and tightest pipe lines in the country.

George Walker. He Believes in Welding Pipe Lines.

The Fitchburg Paper Company, a large paper manufacturer operating four mills in Fitchburg, Mass., were recently confronted with quite an elaborate reconstruction problem. It had become necessary to replace the old boilers in two of their mills. After carefully considering the cost and desirability of putting new boilers in each mill, it was finally decided to install a central power plant in one mill and pipe the steam energy to the other mill. This meant the installation of a high pressure steam pipe line almost a quarter of a mile long.

The Line Traverses a Blue Spruce Grove and Crosses the Road in a Giant S.

The path of this pipe line ran up and down hill following the course of the Nashua River for a short distance, then crossing the river at a point opposite the second mill at a slight angle. The river at this point was 140 feet from bank to bank. As this pipe line would be entirely out of doors and exposed to the weather, there was a lot of discussion as to just what kind of a joint could be used. Consideration was given to the screwed joint and screwed flange and the Vanstone joint, but it was decided that the welded joint would be the best type to use.

Views of Bridge Which Was Built Especially to Carry This Welded High Pressure Line.

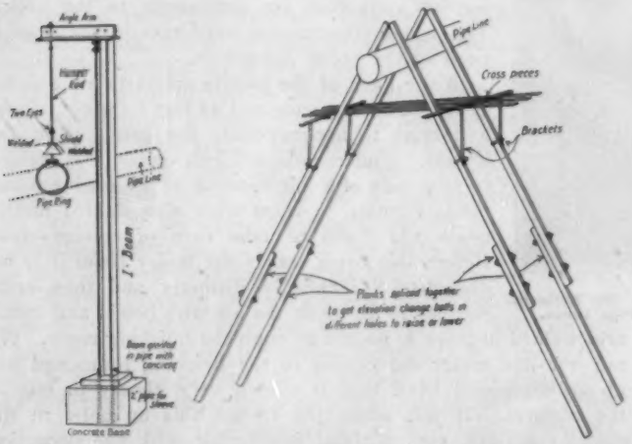
A large Bigelow-Hornsby water tube boiler, capable of producing over 2,000 horsepower, was installed in the boiler room of mill No. 4. This boiler, which is itself a marvel of engineering, contains many welded units that are accessories to the boiler. The whole construction conforms to the regulations of the boiler inspectors.

In the back of the boilers we installed a drum 12 inches in diameter and 42 feet long containing 9 nozzles to accommodate the bends from the boilers. Underneath, a 5-inch nozzle was welded to take care of a line running to the engine room. Drips running to traps were also welded underneath the drum to take care of condensation. Before this drum leaves the boiler room it is reduced to 8 inches in diameter and then commences to go up in the air with bends and measures welded in place to go out through the finishing room. We ran our line under the ceiling in the finishing room and put up an expansion bend that is shown very clearly in one of the pictures. It was some job to put this up between the posts, machines, etc., without interfering with the operation of the machinery or slowing up the production. This bend at the smallest part of the opening measures 3 feet from center to center, and the wide part of the bend is 17½ feet in diameter. The line is, of course, anchored in the room, care being taken, of course, to allow for expansion. From this room the line runs opposite the mill through a grove of blue spruces. This work was being done right at the Christmas season and it seemed appropriate to be working near the Christmas trees at that time. However, during the months of December and January the thermometer in this particular locality was registering anywhere from 20 degrees above zero to 10 degrees below, a fair average being 15 degrees above. A severe wind was blowing a good part of the time and on windy days the dampness and moisture from the river did not add anything to the comfort of the welders.

We carried this job along in all kinds of weather, snowstorms

included. Many a morning we had to dig up lengths of pipe from under snow that was not there the night before.

The photographs of the line show the pipe suspended from uprights of a special eye-beam type supporting an arm made out of double angle irons. These angle irons are riveted together with one-inch spacing washers to allow a clearance for the hanger rod. The hanger rod has two eyes, allowing freedom of movement in any direction. Down near the eye that attaches to the pipe clamp or hanger itself is a rain shield, a conical shaped hood welded to the rod so as to shade the rain and snow and prevent any dampness or water leaking down to the covering. We call these shields "umbrellas."



This type of suspension is very practical because regardless of the velocity of the wind, internal pressure or outside strain the line can give in any direction.

Our pipe came on the job beveled for welding and owing to the unevenness of the ground most of the joints had to be welded in the air since the process of lining-up, etc., would consume a great deal of time.

The line crossed the road at one point, which is shown in one

Expansion Bend Inside the Plant

of the photographs, and this was made to answer a practical purpose by putting in an expansion bend here in the form of a huge letter S.

At the top of the hill we welded on a 4-inch drip pocket with a side outlet for blowing out the line and relieving the condensation up to that point when the steam is turned on. It has so far to travel against surface resistance in cold weather that this provision must be made for condensation. Then we carried the line down the hill, turned, and crossed the river on a skeleton bridge of structural iron which was erected for this purpose. Bends were made at both ends of the bridge and another bend where the line entered the No. 2 mill.

The variation of the grade was such that we were anywhere from 30 feet above ground to 4 feet at the top of the hill and about 50 feet above the river bed. At times, while welding was going on on the bridge, the water of the river came over the dam so fast that enough spray was formed to give the welders a thorough soaking. Welding goggles would become clouded and the situation was generally uncomfortable, but after awhile the wind would shift and blow the spray back toward the waterfall.

When we lined up our pipe we clamped it in place, tacked it in four places, removed the clamp and welded the joint, starting on the bottom of the joint and working upwards toward the top, then starting at the bottom on the other side and working up to the top until the joint was completed.

After welding, each joint was annealed by heating the entire joint and the adjacent surfaces about 8 or 10 inches wide to a cherry red, thereby relieving any stress or strain that might have been set up by the welding process and complying with the insurance specifications that govern the welding of lines like this.

Considerable rigging had to be done before this job was complete because putting up stagings on uneven ground covered with ice and snow is a problem in itself. Too much credit cannot be given to the foreman steam fitter, Mr. C. M. Hall, for his cooperation and assistance on this work.

Our stagings consisted of planks spliced together and brackets clipped on them. We stood them against the line at an angle and laid planks across two ways; then ran the planks at the top to the line and to each other to prevent them from slipping.

This job was tested out on Saturday, January 29, 1927, at 150 pounds steam pressure in the presence of the engineer who laid out the job. Not a single leak developed anywhere along the line. Considering the strenuous conditions under which this installation was made, this certainly is a fine recommendation of the possibility of getting a perfect job of pipe welding.

WELDING AT NEWPORT NEWS SHIPYARD

An interesting account of the launching of the new coast guard cutter, Northland, built at the plant of the Newport News Shipbuilding and Drydock Company, appeared in the February 5th edition of the Newport News Times-Herald. According to this account, arc, gas and thermit welding have been used more extensively in the construction of the coast guard ship Northland than any ship of its size constructed in the world to date. Its decks and superstructure are very largely metal arc welded. It has a completely metal arc welded rudder and four seams at the waterline have been welded in addition to being riveted in the usual manner so as to enable the hull to more effectively resist ice pressure in Arctic service. The stern frame is thermit welded and the sections of a heavy brass bulwark rail around the stern have been joined by gas welding. In addition to the foregoing, all of the tanks not a part of the hull structure have been metal arc welded.

The Newport News shipyard has recently installed much new welding equipment and is now specializing in all types of this work, which is playing an important part in almost all ship construction.

A large proportion of all oil, gasoline, fresh and salt water tanks of merchant ships being built at the Newport News Shipbuilding and Dry Dock Company's works, together with their piping systems, are now being welded and steps have also been taken towards completely welding all of the ventilating system ducts. During the past year the metal arc welding force has been increased from 25 to 65 and a school for the training of welders to supply the demands of the company has been established. The company is also extending the use of welding on its other classes of work, namely, hydraulic work, steel building structures, etc.

James W. Owens, author of "Fundamentals of Welding," is director of welding at the Newport News plant. He is known to the industry as a tireless worker in the interests of good welding and has many friends who will not be surprised at the progress being made in his department.

"Let's Go" On Structural Welding

Roof Is Good Starting Place for Developing Welded Structures—Welded Roofs Becoming Common Practice

By C. J. Holslag*

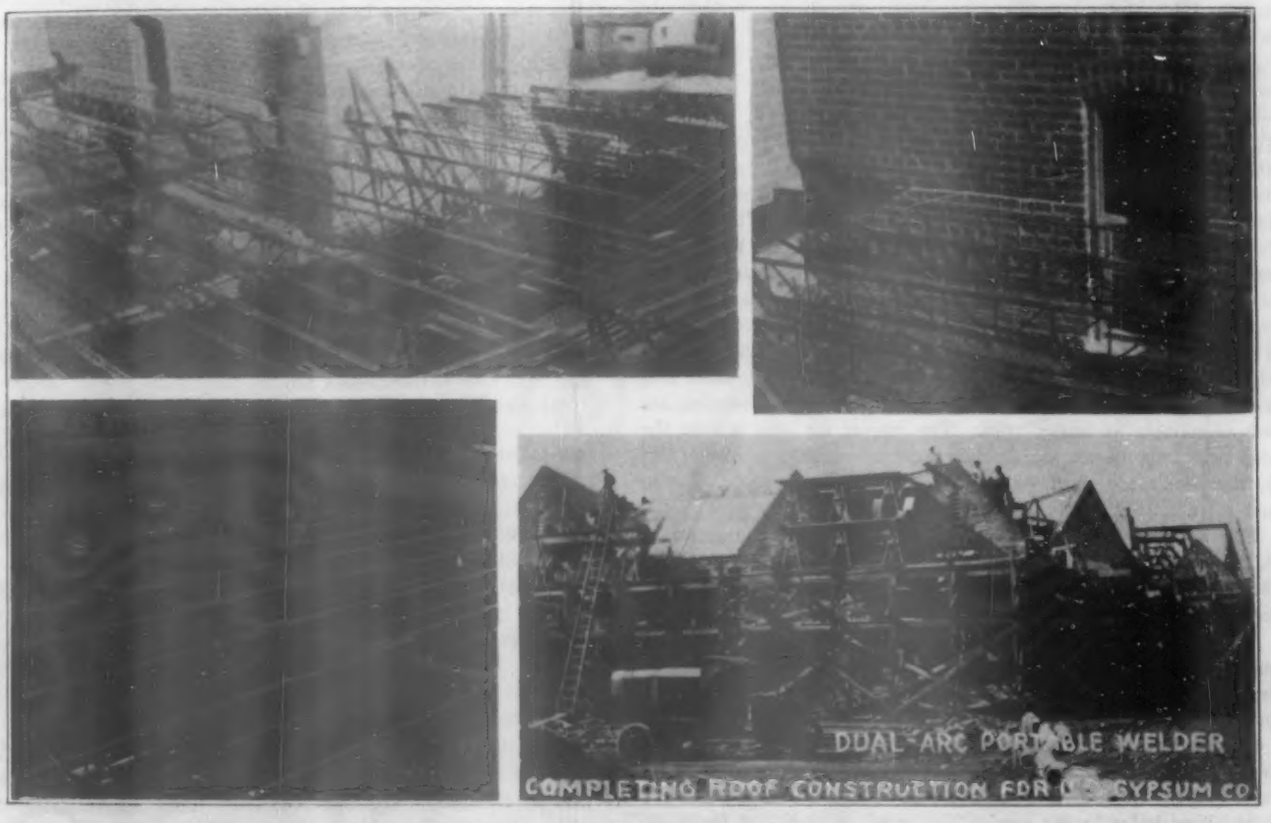
THERE seems to be no valid reason now why the 100 per cent arc welded joint cannot replace the riveted joint with its 50 to 60 per cent strength. There have been so many actual buildings put up, and so many firms are now actually engaged in the process of structural work that all the arc welding process now needs is publicity to have it accepted.

In order to make a 100 per cent joint a certain amount of welding metal has to be put down, but this amount is not unreasonable and costs less than riveting work even in the present stage. The amount of metal that has to be put down to equal the strength of the original material, whether it be shear, tensile, bending, compression, alternating stress or what not, can be very easily figured from the fact that irrefutable tests of tensile strength of the welding metal show 40,000 to 60,000 pounds and the shear strength 30,000 to 40,000 pounds. Taking the factor of safety of four would still not mean any undue amount of welding. These figures hardly need to be substantiated, but by referring to the Wirt Jones test as made at the American Bureau of Standards, as published by the American Welding Society and the American Institute and to the tests made at the G. E. Company in collaboration with Union College and to the tests made in Melbourne, Australia, it will be seen there need be no fear of welding. Furthermore corrosion and aging tests by the U. S. Navy and others show there is nothing to fear from these causes.

Assembling details solve themselves. Attaching plate and turnbuckle holds can be easily made and when they serve their purpose they are knocked off with a blow at right angles to the line of weld. In other words, these temporary jigs and fixtures are weak in one direction and strong in the direction in which they are to act.

It is well known that a tank that is not welded is not considered a good tank. This opinion has grown steadily in the past two years. When it is considered that locomotive boilers and locomotive frames have been pounding over the roads for a very little short of twenty years, there is nothing but psychological inertia to overcome in the application of the arc to building construction.

Of course, the place to start and learn arc welding is not in bridge welding. The best place to learn is in the shop on window frames, door frames and odd pieces, repairs, etc. But when starting building construction it looks as if the easiest place to start is on the roof work because here the most apparent saving in costs results to the builder, and quickest and easiest progress has been made with the welded construction, both gas and electric.



All Welded Roof Trusses; All Welded Roofs; Soon It Will Be All Welded Houses.

The photographs reproduced here show almost the whole story. It appears that all that has to be done is to lay the cut purlins on the rafters and weld them together at intervals and then fill in with the roof material exactly as if the construction were bolted or riveted.

The work is as easy as this, even easier, providing that the welder is expert and conscientious, but along these lines we are not recommending anyone to take welding lessons or practice welding on a roof. First, it is quite disconcerting to weld up in the air with both feet off the ground, and second, a roof is no job to experiment with before knowing how to weld.

Therefore, presupposing that the welder is an experienced climber or that the iron worker has obtained welding experience

(and I don't know which experience is the easiest or hardest to acquire), let me sound one note of warning or one rule to follow that will result in more welded buildings and no failures. The secret is to see and know that both edges are equally penetrated or welded when a welder is perched up on a more or less open roof, or an iron worker with perhaps not as much experience as he will have years hence. There is danger of a nice looking deposit not being equally joined to both members. In practically every case there is a lower and an upper member, even in the case of a flat roof and a good way to make sure that the weld deposit is even is to weld to the lower member first and after the deposit has taken hold there to include the upper member.

The whole trick or knack of metallic arc welding is to steer the electrode or melt the rod into the puddle or crater bowl made on the work piece and then steer this filled puddle back and forth or straight along to join two or more pieces or to fill or cut as desired. Experienced welders will know that the arc deposit should never get ahead of the crater. All others are recommended to study and practice according to the Arc Welding Handbook lessons (illustrated), by McGraw Hill, or some other equally good instructor. It is safest to weld from the bottom up, as described, because the metal then can't run ahead of the arc, and because no tension or hanging strains are put on the weld.

In welding flat roofs or peaked or gabled roofs the problem in welding is simply to have the members in place and weld them where they cross each other as often as they would have been bolted or riveted. A 2" or 3" tack weld is more than equal to the best single rivet on ¼" to ½" thick members and less and more welding is required in proportion to the thickness of members; that is, 3/16" and ten gauge steel would be held by ¼" and ½" tacks and ⅝" and ¾" thick members by a 4" to 6" tack equal in thickness to the members. Note that in these first lessons we are only using the weld to hold members in place and are not involved in stress strain tables of the weld deposit as yet. The weld can be placed where most convenient to get at or divided equally, but in this regard it must be kept in mind that welds shorter than 3 to 5 times the thickness of the member are not as reliable as longer ones. The reason for this is that the stop and start of an arc weld are not as reliable as the center portion and a too short weld has too great a percentage of stop and start.

For builders who are using welding, but looking askance at it, the welds can always be placed in such a position, generally on the lower side, that the piece could not slip out of place even if welding was as bad as was feared.

This roof welding is of the simplest construction, using existing tried shapes and methods and imitating previous construction throughout. Perhaps the only innovations are the welded Massillon or Concrete Steel Company's Havemeyer welded girder or joist and the J. & L. Junior beam or the combination roof girder developed by J. G. Dudley of Teaneck, N. J., where a wood furring strip was fastened to a flat steel strip by nails through tight filling holes in the steel. The wood is used for fastening the roof material in the conventional manner; the steel being welded at the eaves to an angle open side up and at the top to a peaked angle forming the ridgepole. At gables and special work the strips were welded to each other and the whole stiffened by cross strips where windows or gables did not already provide that feature.

The welded girders are ideal for welding, as you will notice from the photos, having an extension at each end for laying on the girder or cross beam, and allowing flat welds and open spaces for piping and conduits, whereas existing beams or channels either must be arc welded, butted or their width lost in head room. In any case, conduits and pipes cross with difficulty with standard sections. It is a good plan to box in or to use standard sections at ends and partitions because they stiffen the structure and look reassuring to experienced constructors.

It appears as if roof construction is the logical place to strike out after exhausting the structural welding uses in a shop on window and door frames, stair and ornamental iron work, etc., and we who know a weld is not affected by corrosion or aging, and that if made heavy enough it will not deteriorate from any mechanical strain, are each and all looking forward to its more prevalent use because it is the only way a 100 per cent joint can be effected.

WELDING CONFERENCE AT NORTH TEXAS AGRICULTURAL COLLEGE

Nearly two hundred men attended the welding conference held March 4th at the North Texas Agricultural College, Arlington, Texas. The meeting started at ten in the morning and held the undivided attention of the crowd until late in the evening. Following is a copy of the program of talks and discussions:

9:00- 9:45—Visiting.
9:45-10:00—Welcome Address, Dean E. E. Davis, North Texas Agricultural College.
10:00-10:45—Welding and Oxygen and Their Application to the Industry.
10:45-11:00—Questions and open discussion, S. G. Hord, Burdett Oxygen Co.
11:00-11:45—Training of Welders.
11:45-12:00—Questions and open discussion, G. O. Carter, Consulting Engineer, Union Carbide Co.
12:00-12:45—Dissolved Acetylene and Its Relation to Welding.
12:45- 1:00—Questions and open discussions, P. C. Avery, Consulting Engineer, Avery Press Steel Co.
1:00- 2:15—Lunch.
Address by N. S. Hunsdon, State Supervisor of Industrial Education.
2:15- 3:00—Manufacture of Welding Equipment and Its Relation to Welding.
3:00- 3:15—Questions and open discussions, I. F. Fausek, President, Modern Engineering Co.
3:15- 4:00—Pipe Line Welding.
4:00- 4:15—Questions and Open Discussion, Mr. W. C. Swift, American Brass Co.
4:15- 4:45—Needs of Industrial Education, T. E. Thorne, Plant Superintendent, Northern Texas Traction Co.
4:45- 5:30—Oxygen and Acetylene Regulators.
5:30- 5:45—Questions and open discussion, Mr. La Due, Bastian-Blessing Co.
5:45- 6:30—Visiting and inspecting the College departments.
6:30- 7:30—Dinner.
7:30- 8:30—Motion picture on welding. Gas Products Association.
8:30-10:00—Motion pictures on Tobin Bronze, Accompanied by Engineer from the American Brass Company.

74 MILE WELDED GAS LINE

One of the largest jobs of welding in the industrial history of Southern California just has been undertaken by the Lang Transportation Company, of Los Angeles. This contemplates the welding of a 74-mile natural gas pipe line extending from Ventura, Cal., to Los Angeles. The line will consist of 15 in.-39,383 cast iron pipe and will be welded by the oxy-acetyline process.

The line is being laid by the Ventura Fuel Company, the Los Angeles Gas & Electric Company and the Southern Counties Gas Company and will convey natural gas from the Ventura oil fields to the city of Los Angeles. The first 44 miles of the line will be laid by the Ventura Fuel Company and the remaining 30 miles will be laid jointly by the two gas companies. The contract for that portion of the line which will be laid by the Ventura company, involving 4,646 tons of cast iron pipe, recently was taken by the Youngstown Steel & Tool Company, of Youngstown, Ohio, which company agreed to roll the pipe at the rate of a mile a day. The entire quantity of pipe will be shipped from Youngstown to Baltimore and thence by water to Los Angeles.

Trenching for the line was begun by the Lang Transportation Company on January 26.

Wrenches Made to Order

A Discarded Ford Leaf Spring Can Be Fashioned Into a Whole Kit of First Class Tools by a Skillful Gas Welder

By Will Stewart

Bert's boss held out a crooked shaped, open-end wrench. "Here," said he, "is a wrench for adjusting the brakes on cars using balloon tires. The mechanic wants us to make two just like it. They must be exactly like this and must be of hardened steel."

Bert took the wrench and noticed that it had been hand-made from low carbon steel. The head was at a fifteen degree angle, the handle was undercut and curved. "Well," said he, "to forge out a wrench of this shape would take quite a bit of time, but now if I were to cut it out with the cutting torch, I believe that it could be done fairly easily."

So he looked for a short section of the spring leaf. He laid this on the table and traced out the form of the wrench on it with his soapstone pencil.

To a friend, Bert had mentioned that he was cutting High Carbon Steel and making tools of it. "It can't be done successfully," stated his friend. "I did it," cut in Bert. "But what I meant," said the friend, "was that the high, sudden heat from the cutting, causes cracks in the article and though they seldom show up right then, later, when the tool has been hardened and tempered, they will come into view, fine hair cracks, and the tool will break when a strain is put on it. I know, for I, too, thought that I could make tools out of Ford springs and then nearly every one that I made has come back to me, all showing the fine expansion cracks."

"Sudden expansion—cracks," thought Bert, and he mulled over the subject in his spare time till an idea came to him and now he had a chance to try it out. He would make but one wrench and then see if he could break it.

He built up the furnace so that the section would lie in it, knowing that the tracings of soapstone would stand quite a high degree of heat. He started the preheating torch and let the spring get red hot before he lit the cutting torch, and then he started to cut. It cut easily and about as smooth as low carbon steel. He was careful to cut just outside of the tracings and then he let the heating torch burn till the wrench blank which was still sticking to the rest of the piece, by the slag, had taken a uniform red.

Cutting off the flame, he allowed it to cool down till the red was just turning to black. He tapped the blank and as it fell away from the outer metal, he picked it up and dropped it in the oil tub, to anneal.

Annealing may be done in several ways, the slow ways are: Heat the article to red heat and close up the furnace and let cool (12 to 18 hours pass before you can remove the article). Heat to red heat and bury the article in DRY Asbestos, leaving it in there till entirely cool.

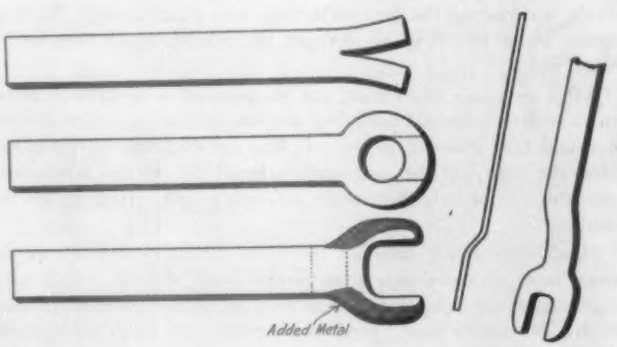
The quicker ways are: Heat to red heat and lay the article on a board thickly covered with sawdust and cover with another board (the board flames up, so it must be placed in a fireproof place). Heat to red heat and then let the article cool down till it becomes black or till a pine shaving will just char as it is pressed against the heated metal, then dip the article in a cooling medium (warm water; soapy water; water with a film of oil over it, or in a bucket of oil).

If care is taken, the article will come out soft enough to file or saw easily. Bert lifted out the blank and after washing off the oil, he ground it down nearly to size. He left the opening a thirty-second under size, as the sudden cooling of the red hot steel in the hardening medium had the power of stopping the contraction of the fast cooling metal and so, to a slight degree, the size of the opening or openings are changed so that they are a few thousandths of an inch larger, depending on the size of the article, its carbon content and the degree of quenching heat, as well as the kind of cooling medium and whether it is cold or warmed before the article is quenched in it.

Bert returned to the furnace and placed the wrench upon the bricks so that all sections would heat equally and so that it was well supported and could not sag as it grew red hot. He lighted the torch and stood waiting for the wrench to come to cherry red.

Taking up the red hot wrench with the tongs, he dipped it straight down in the oil tank and swirled it around so that the opening would lose its heat as quick as possible and be glass hard.

Then taking out the hardened wrench, he took it over and washed off the clinging oil, tested it for hardness and polished it. Going back to the table he lit the torch and moved the flame about so that while the handle drew to brown tinged with blue, the opening only came to yellow-brown.



He returned to the finishing wheel and now took a fine cut off the sides of the opening, till it was a sixty-fourth oversize, for a twenty-five thirty-seconds milled opening.

Going over to the stock boxes he hunted about till he found a hex. bolt that fitted the wrench opening, and taking it over to the vise he cinched up on the shank of the bolt and then sought to turn the head of the bolt around. After some tugging and twisting it turned and, knowing that he was turning the bolt around between the jaws of the vise, he tightened them up, and slipping a piece of pipe on the end of the wrench, gave a mighty heave, but nothing happened. Bracing his foot against the bench, he tried again and went slithering down along the floor.

He got to his feet and picked up the pipe with the wrench wedged in it. He had at last succeeded; he had broken the wrench, but no cracks or flaws did he see in the break. The grain was close and the break showed that it came from pressure too high for the jaws to withstand.

Just then the boss came over. "What's this?" he asked. "Just seeing how easy my test wrench would break," answered Bert, and his face showed satisfaction. "I had to put a pipe on the end of the handle and brace my foot against the bench before I could break it. Yep! No mechanic will ever give a wrench a pull even half as hard as this, and my friend said that wrenches made of Carbon Steel with a cutting torch, would break just as soon as you started to pull on them."

He then returned to the welding table, after getting out another rear spring, which, by the way, if Genuine Ford Springs, are marked with the Ford marks and are, of late years, made of Chrome Vanadium, Carbon steel. Always hunt for the Ford mark, as then you will get a piece of steel that will make wrenches far superior to what the ordinary or imitation Ford springs will be when fashioned into wrenches or tools.

It was about a week later that a customer came in with a drawing of two wrenches, one with a one-and-seven-eighths opening and the other with a two-and-three-eighths opening. The boss, having all the faith in the world in Bert's ability, took them without consulting him.

"Here's a couple more wrenches for you to make from Ford springs," said he, handing Bert the sheet of paper, "and here are the nuts that they are to fit," said he, handing Bert a couple of battered bronze nuts.

"Great Grief," muttered Bert, as he laid the smaller of the two nuts on a piece of the Ford spring. Ford springs are two inches wide and about five-sixteenths thick. "Let's see what the diagram says.

"Three-eighths thick, first bend three-quarters of an inch from the back of the opening, one and a quarter inches between that and the next bend and a handle of twelve inches for the smaller wrench, and fourteen inches on the larger one. To be of hardened steel and guaranteed.

"It's a darn good thing that I am a welder as well as a cutter," muttered Bert, " 'Cause I sure am going to have to do some building up." He got another full length spring from the bin and after figuring decided that the smaller of the wrenches would need about eighteen inches, marked it off and lighting the preheating torch, warmed up the first section he was going to cut. Then as he set about to cut it, he changed the heating flame over to the other end.

After he made the second cut he punched a small hole about an inch from one end and then set the preheating torch so that it would heat this end to red. It was his idea that he could expand the hole and the surrounding metal till he had somewhere near the size of hole that would do with a little grinding, for the opening.

Slowly the punch enlarged the hole, it was slow work as the metal next to the punch soon turned black and he would have to return it for reheating. Each time he turned the wrench over so that the punch would enter the tapered hole from the opposite side.

At last, his last tapering punch was used, and the hole was still too small. He now tried forcing it on over the horn of the anvil and, using a large pipe to swage it down with, and then at last he stood there disgusted; he had a hole almost an inch and a half and he doubted if he could expand it farther.

He stood scratching his head and thinking and at last an idea was stirred up: "Build up around the outer side and cut out as you did on the brake adjusting wrench."

He laid the wrench down so that he would have access to one side, and picking up a rod of high carbon steel he lit his welding torch and set to work adding metal. Now he turned the wrench over and added metal on the other side; about three-eighths of an inch was added on each side.

Taking up the bronze nut he marked off the cut and after a little heating he set to work, leaving as he had before, enough stock that he could grind down under the oxidized side of the cut.

"No brains, Old Kid," said he, "if you have to build up on the outside why waste all this heat and strength in making a hole, why not just split the end down for an inch or so, build up the outsides and cut out as you did in this case, Huh?"

He set the curved spring down, measured off some twenty inches and soon had another strip ready. Sticking the hardy in the anvil he set the red-hot piece down on it, and hammered till it gapped open, then reheated it and forced open the slit till the two upper tips were about three inches apart.

He had had a bit of oxidization while adding metal to the other wrench, because the filler rod was too small, so he stepped over to the scrap bin and returned with a coil spring, which he heated and uncoiled. Now he had a high carbon rod about three sixteenths of an inch in diameter.

Using this rod he built up the outer edges till testing with the larger of the nuts, there was plenty of stock. He popped off the torch and set the welded head away where it would get the heat of the torch. And now again he took the cutting torch and roughly cut out the opening.

After annealing the two wrenches he took them to the grinding wheel and roughly finished them to shape. Then he reheated them and made the bends and now they were ready for hardening. But this time he did not bring them to so full a cherry red nor when he tempered them did he draw them so light.

He drew the handles to blue, the bends to blue and held the lower faces at brown tinged with blue for the nuts that they were to work against were of soft metal and he felt that to leave them slightly more tough and springy, would give them longer life.

As Bert was returning from lunch that noon, he saw the sign posters plastering on a new Ford sign. It said: Tenth Million Fords Now in the Hands of Owners! "Well!" said Bert, "Henry can make them and the drivers can break them springs lots faster than I can use them up."

FRENCH ENGINEER ACKNOWLEDGES COURTESIES EXTENDED BY AMERICANS

In the current issue of the Revue de la Soudure Autogene Francaise appears the following note of acknowledgment:

"We announced in one of our earlier numbers that M. J. Brillié, Chief of Technical Service of La Soudure Autogene Francaise, was leaving for a voyage to the United States and that our office had asked him to report in as much detail as possible such developments as would be of service to our clients.

"M. Brillié has just returned from that mission. He stayed several weeks with our American friends, who extended to him an exceptionally cordial welcome. Shops, offices, laboratories and gates were opened and made accessible to him. He was shown everything, was taken everywhere and his questions were answered in detail on every point.

"M. Brillié has told us how much he was touched by this welcome, tendered first to the Frenchman and then to a fellow worker in the development of oxy-acetylene welding, coming on a special mission to them from a country for which the Americans profess a very great admiration.

"Among the personages in the industry who so cordially welcomed M. Brillié he has asked us to thank the following publicly in our journal: A. Cressy Morrison, H. S. Smith, S. W. Miller, G. L. Bourne, J. W. Meadowcroft, H. S. Card, H. P Allstrand, J. B. Green, W. A. Slack, J. F. Harper, H. R. Pennington, R. K. Randall and Mr. Osterman.

"We wish to include here our hearty thanks, particularly to Mr. Morrison, who has been Secretary of the International Acetylene Association since its foundation. We recall that in the course of M. Brillié's visit the International Acetylene Association awarded to Mr. Edward Fouché the Morehead medal, a splendid homage rendered by our American friends to one of the promoters of oxy-acetylene welding.

"On our part it is a pleasure to assure American engineers that when they in turn come to France we will do our best to receive them as cordially as they have received M. Brillié. Even though we may lack the equipment, since the organization of industries in France is somewhat different, our welcome will nevertheless be made with an equal spirit of friendship. We hope especially that on the occasion of the Ninth International Congress, which will be held in Brussels next July, we will have the great pleasure of counting among the visitors many of our American friends and that on that occasion we will be able to entertain them a few days in Paris."

Investigating Spot Welds

Don't Take a Spot Welder for Granted—Study Its Operation from Every Angle, and Keep It Working at Best Efficiency

SPOT welding operations run quickly up into the thousands in the daily production program of plants making sheet steel products. The process has made a remarkable difference in the cost of producing sheet metal articles as compared with the old riveting process and because of the nature of the welded article as compared to the small rivet, the former is generally conceded to give better service for a longer period. The number of assemblies where a rivet would really be preferred to a spot weld is so small as to be almost negligible.

Because of the simplicity of operation of the ordinary spot welder the process is not generally thought of as presenting any particular operating problems. The quality of the joint produced is generally conceded to be easily superior to riveted work and machinery has been perfected to the point where there is scarcely any difficulty in training operators to the work.

However, as the thickness of the metal changes the volume of work from one or more machines increases. It becomes necessary from time to time to investigate spot welds from a number of different points of view.

Mr. G. A. Hughes, writing for the Iron and Steel Engineer some time ago, described a long series of tests which illustrate quite clearly in what directions work can be improved or results verified through systematic investigation. The tests were made with Federal spot welders.

The question of spot welding plates one-half inch thick on 30-KW. hand-operated machines was investigated by making four spot welds on two pieces of steel of this thickness, three inches wide. The tension test of this sample was 35,100 pounds. Sufficient pressure to force the material together after heating could not be obtained on this small machine. When a similar test was applied to 12-gauge sheet the spot pulled entirely out of one sheet.

When a piece of 14-gauge sheet was spot welded to a piece of quarter-inch plate and the pieces pried apart with a chisel, the spot weld remained on the plate and the thin sheet just tore loose. The same thing happened when the 14 gauge sheet was spot welded to a piece of half-inch material and when two pieces of 14 gauge were welded together for comparison the sheet tore when pulled, leaving the weld intact. This rough though practical investigation shows conclusively that pieces do not have to be of the same thickness to insure a perfect weld.

A double lap joint in 3-inch wide plates of $\frac{3}{16}$-inch material when pulled failed in the plate at 25,500 pounds. That is, the shearing strength of the four spot welds made with $\frac{1}{8}$-inch electrode contact was greater than 6,500 pounds each. Four single lap joints made with a $\frac{1}{8}$-inch contact electrode held until the plate failed at slightly over 25,000 pounds.

In another test two pieces of $\frac{3}{8}$-inch steel two inches wide were welded with four spots. When tested the welds broke at 44,650 pounds tension. The total area of welded section was .476 quarter-inch. A piece of this same steel showed an ultimate tensile strength of 66,800 pounds per square inch. This would show the shearing strength of the weld to be stronger than the tensile strength of the material.

In order to get a comparison of the shearing stresses of spot welded and riveted joints in 14-gauge sheets three samples were riveted together and three samples were spot welded. One of the riveted samples contained only one rivet, the second two rivets and the third three rivets. One of the welded samples contained one spot, the second two spots and the third three spots. The test pieces were three inches wide. A single spot was put in the center of the sheet 1½ inches from the edges. In the one with the two spots they were placed at inch centers and one inch from the edges. In the sample with three spots they were placed in the form of an equilateral triangle one inch on centers and one inch from the edge. The results of this test are shown in Table I.

The sample with one spot tested higher than the average of the two and three spot samples, as did also the riveted samples. The rivets were located in the sheets with the same relation as the welds. This was judged to be due to the welds and rivets not taking the load evenly, with the result that one was partly ruptured before the others were fully loaded.

Observation of the actual welding operation indicated that there was quite a difference in the heating rate. So it was necessary to study the conditions which may have an effect on this. The heat generated depends upon the amount of current flowing and the resistance. A change of pressure makes so much difference in the contact that the resistance of the circuit will be changed. A false impression of conditions can be obtained when rust, scale or dirt on the stock causes burning of the sheet. Where the electrode touches while at point of contact between the sheets there is not sufficient heat for welding. Too much pressure will decrease the resistance so that the rate of heat is too slow, while too little pressure will cause arcing with poor welds as a result. It is found that rust and scale can be burned off from heavy sheets by switching on the current for just an instant, then switching it off to get the proper contact on with the electrode before going ahead to make the weld. Information of this sort is invaluable to the owner of a spot welding machine which is counted upon for continuous production duty, and it is worth while to take the necessary time to make investigations in order to get started correctly on the work.

TABLE I

Test No.	Size of spot.	Maximum load lbs.	Nature of failure.	No. of spots.
1	5/16 in.	4460	weld pulled out.	1
2	5/16 in.	7250	welds pulled out.	2
3	5/16 in.	10920	welds pulled out.	3
4	One ¼ in. rivet was used, hole drilled and rivet inserted with care.	2920	Rivet sheared	
5	Two ¼ in. rivets were used, holes drilled and rivets inserted with care.	4700	Rivets sheared	
6	Three rivets were used, holes drilled and rivets inserted with care.	8390	Rivets sheared	

So much work is done on low carbon steel that general statements are often made regarding spot welding without making note that conditions would have to be changed if a different grade of steel were used. The chemical properties of material have a decided effect on the amount of pressure required, just as the thickness does. High carbon steel, for example, will not heat readily if a great amount of pressure is used. Consequently it requires a heavier current.

Welding two pieces of $\frac{1}{8}$ inch mild steel plate at 220 volts, 244 amperes, 24 K W it required 15 seconds with 50 pounds presure to produce a $\frac{3}{8}$ inch spot weld. On two pieces of alloy steel of the same thickness with 260 amperes, 20 K W, 220 volts the same size weld required 20 seconds at 120 pounds pressure. This work was done in a 35 K. W. machine having a 30

inch throat. In making the weld on alloy steel it was estimated that 9,000 amperes were flowing in a secondary circuit.

Table II is a compilation of the results obtained in a comparative test between an automatic 2 spot machine and a single spot machine manually operated. Here the two methods were compared on sixteen different counts.

Another question that comes up is the current consumption for a day's work. It is not safe to estimate this without knowing exactly what work is to be done, as will be shown in the following table giving the results of two different ten-hour periods. The figures show that the period in which the most welds were made really consumed the least amount of current:

TABLE III.

1480 Welds of two pieces No. 18 gauge sheet steel.
1050 Welds of four pieces No. 16 gauge and 1 piece $\frac{1}{4}$ in. plate.

2530 Welds in 10 hours. Energy consumed 42 kwh.

680 Welds two pieces No. 18 gauge sheet steel.
1350 Welds four pieces No. 16 gauge and one $\frac{1}{4}$ in. plate.
545 Welds one piece No. 18 gauge and one piece $\frac{1}{8}$ in. mild steel.

2575 Welds in 10 hours, energy consumed 35 kwh.

A favorite method of checking up on welding operations is chemical analysis of the material. Following is a typical report of a piece of plate which had been spot welded, as received from the chemical laboratory:

1. From center of weld. Sul., .038; Phos., 1020, Mang., .59; carbon, .08.

2. From edge of unwelded section but affected by heat: Sul., .042; Phos., .019; Mang., .60; carbon, .08.

3. From plate unaffected by heat: Sul., .040; Phos., .021; Mang., .58; carbon, .08.

Electrical problems involved in the installation of spot welders depend upon the capacity of the machine and the number of machines installed. Therefore, it is advisable to start right in this direction. The safest plan to follow is to give the manufacturer of the spot welder complete information regarding the power supply and get complete specifications for making provisions for installation of a resistance welder.

It is safe to approach the subject of spot welding from the point of view that spot welds are at least as strong as riveted joints. The tests indicate that they are really stronger In case, however, there is any doubt about the efficiency at which machines are operated it isn't safe to assume that the trouble is with the machine nor with the process. There are a great many angles from which the process can be studied and investigations such as those discussed above can be expected to suggest best methods for handling work in individual cases.

WELDED FLY WHEEL

By E. J. Edwards

These photographs show a steam engine flywheel we welded last October. This wheel was 54 inches in diameter with a 12-inch face, weighing 900 pounds. Each spoke was broken in two places, and there was one break in the rim, a total of thirteen breaks. We welded the six spokes to the hub and then allowed it to cool so we could line it up to the rim. After grinding and chiselling the breaks we lined it up on a wheel plate with fire-

It's Never Too Late to Weld.

bricks and preheated it for four hours with a Hauck preheater. Two preheating torches were kept on the wheel until the job was finished. It took 25 gallons of coal oil to keep it red hot all over. One torch was kept on the spoke ahead of the welder. We welded the six spokes on one side, then turned it over and welded them on the other side making the rim weld last. The rim is three inches thick in the center. After welding, we left the preheater on the wheel for an hour to bring it to a uniform heat. Then five hours were allowed for cooling. We used a grinder on the parts that came in contact with the belt and clutch shoes. When finished the wheel was in perfect alignment, and has been running ever since to the complete satisfaction of the owner. This job was done in a country welding shop without any special equipment.

TABLE II

Comparison of welds made with Single Spot Manually Operated Machine and Automatic Air-Operated Two Spot Machine. Material—Two 14 ga. plates and one 3/16" plate arranged thus— ═══ Two spots in each specimen.

	Automatic Two Spot Machine							Single Spot Machine						
	A_1	A_2	A_3	A_4	A_5	A_6	Ave.	B_1	B_2	B_3	B_4	B_5	B_6	Ave.
1. Voltage	208	206	202	204	208	202	205	212	212	211	211	210	212	211.3
2. Current	296	344	352	360	344	352	341	240	245	242	240	240	240	241.1
3. Top of Auto. Transformer	7	8	8	8	8	8	___	8	8	8	8	8	8	___
4. Kilowatts consumed	36.8	41.6	41.2	41.6	42.0	41.2	40.73	24.5	24.5	23.5	24.0	23.5	23.5	23.91
5. Power factor	60	59	58	57	59	58	58.5	48	47	46	47	47	46	46.83
6. Condition of sheets							Fair							Fair
7. Condition of electrodes							Good							Good
8. Sizes of contract	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"	7/16"
9. Press, at electrode cont.	205 pds. to heat — 1060 lbs. compress—							700 pds.						
10. Time of weld (sec.)	*12.0	5.4	6.6	9.0	8.4	8.4	8.3	7.8	6.15	6.3	6.3	6.2	4.5	6.21
11. Area of weld	.0494	.0421	.0648	.0810	.0629	.0680	.0614	1035	.0910	.0870	.0852	.0856	.0840	.0870
12. Condition of weld			Good								Good			
13. Nature of failure	Weld	Weld	Weld	Weld	Weld	Weld	____	Weld	Weld	Weld	Weld	Weld	Weld	____
14. Load at failure	15670	13190	19700	17700	18950	16790	17000	10970	18310	18165	18520	18060	19760	17297
15. Load per spot at failure	7835	6595	9850	8850	9475	8395	8500	10970	9155	9083	9265	9030	8800	9383
16. Current in weld	12500	12500	12800	13200	12500	12800	12710	8000	8200	8100	8000	8000	8000	8050

Some Facts About Welded Joints

The Old Superstitions About the Greater Reliability of Rivets Are Gradually Giving Way Before New Evidence in Favor of Welds

By S. J. Melville

A RECENT very critical and (in my opinion) unfair article on the subject of welding versus riveting prompts me to take up the challenge thrown down to us of the welding fraternity.

Some question seems to be raised of authentic data with reference to welding not being available. Well, the tank tests held by the Bureau of Standards in Washington and more recently the structural tests conducted by Westinghouse give sufficient proof of strength of welded joints.

With reference to costs, in most every line of plate work, that is being performed all over the United States on every class of work, in direct competition with riveting, there is no question as to which is the cheapest method of fabrication. Very accurate figures on all types of plate welding butt, lap, fillet, etc., can be given for all gauges of plate, design of joint, position of welding and amount of filler rod, estimated down to a very close margin. Cost data on structural work as yet cannot be very accurately given, for the field is just opening up, hence the tremendous opposition from those opposed to a more modern and efficient process, displacing what was good enough for grandfather.

Dependability

We are all aware of the fact that there have been welding failures in the early stages of the game and even to a limited extent today; but what percentage of those can be laid to the process, design, or workmanship? Welding has progressed in every way considerably in the past few years, but even today there are sharp practices in some shops, such as using fence wire for filler material. How many shops doing welding even on a small scale, have responsible supervisors in charge of the work? As a general rule they are mechanics, or in fact anything *but* welders. Such complaints as poor design, set-up, wire and such trivial matters are entirely ignored by the majority of engineers in charge, who consider them the usual kicks of shop hands.

The standing monuments to the dependability of welding all over our country are too numerous to mention in all fields of construction and manufacture.

The all-welded kilns 125 by 8 feet, miles of piping used for every imaginable purpose, from 1-inch to 10-foot diameters, gas house equipment, automobiles, the huge gas holders in Australia, smokestacks, several buildings in England, tanks of all sizes and for the highest pressures and a vast assortment of apparatus in almost every industry, some of which have seen the most exacting service over a period of years without failure; yet some of our friends in the riveting game tell us that welding is not reliable. A great many of them claim that there has never been a riveted failure. Well, I have seen some. The bridge may not have fallen down even if half the rivets sheared off. Proof enough that there were probably twice as many as were necessary in the first place.

As I understand it, the rivet when driven is supposed to fill the hole and grip the plates. The claim is made that by hammer test it can be verified to the satisfaction of inspectors. Again, that there is no visible means of ascertaining in a welded joint whether the fusion is good, by outward appearances. A rivet when driven hot usually shrinks on cooling. What fills the hole completely then? And in the case of plates not being together tightly and rivet flared out between them, by what test can inspectors discover this? What strength has that rivet in shear or how long will the joint remain rigid? Welding is not a cure-all, but unfortunately it has been so considered by a great many ill-informed and over-enthusiastic individuals. It is fundamentally a very definite process, established beyond a doubt as the most efficient and economic method of joining metals yet devised. There is no way of testing a concrete structure after completion yet it is accepted as good engineering practice. Why the big question mark and all the talk about the human element when welding is mentioned?

Railroads have been pioneers to a great extent in that line, and I have yet to see a properly executed firebox weld by a competent operator turn out to be a fizzle endangering life or property. I have seen a great many so-called welders working on all classes of railroad work, but with proper supervision their rightful classification would be on the section gang with a pick and shovel. Railroads which have organized their welding forces systematically, from the ground up, are getting phenomenal results in economy and efficiency; they would be rather amused at the suggestion of going back to patch-bolts, new side-frames, guides and such antiquated and expensive methods of repair. A great deal of the large earnings and wonderfully efficient service they have given this year with record-breaking traffic, is in no small measure due to welding, in keeping their rolling stock up to the market.

Flexibility

How does welding compare with riveting in knock-down erection in the field? The firm that I am connected with recently put on a large self-supporting all-welded gas-tight roof on a large gasoline tauk in a little over half the time and at two-thirds the cost of a riveted one. Personally, I have never seen a riveted roof remain gas-tight for any considerable length of time after moistures got in between the laps. Another instance was a 10-ft. extension welded to the dephlagmator of a cracking still, supported on a tower 75 feet high. (Shell of $\frac{1}{16}$" plate, straight butt-weld.) A riveted job would not have been accepted. This still has been in continuous operation for two years at about 100 pounds pressure, 600 deg. F. and the weld has not shown any distress as yet, which is a fair sample of reliability and flexibility of welded construction. Three 10 by 42 foot 10-inch tanks D and F heads, straight butt-weld, were jacked up on both ends clear of ground and rolled on to flat cars on two timbers only under extreme ends. When unloaded, they were rolled about a quarter of a mile over very rough ground, skidded into place, tested to 40 pounds and found absolutely tight. How many riveted tanks of same material and dimensions could make a similar showing?

Effects on Public and Labor

Nobody's eyesight has ever been affected permanently by the glare of the torch or arc and at thirty feet it is harmless, as the rays are absorbed in the intervening space. The labor question at this time is not so easily solved, however. In boiler and especially structural welding none but the most skillful supervision and welding operators should be employed. Although there seems to be apparent shortage for that class of work, there is no question but what sufficient can be obtained, if the wages are commensurate with the skill. It is not reasonable to suppose that highly skilled labor can be obtained at the rate paid for hod carriers, but unfortunately the prevailing idea seems to be that any one can become a welder within a few weeks' practice and a bit of coaching; but not a riveter, as that is supposed to be a very skilled trade. Any one sufficiently strong in the body and

with a fair amount of intelligence can learn to drive rivets in a very short time, as witness the numerous foreigners employed in structural shops, who can hardly understand a word in our language yet do very efficient work.

Rigidity

It is not possible to keep a riveted structure absolutely rigid after being in service a certain length of time, especially if it is exposed to the weather. Any bridge or boiler on examination will disclose a certain amount of loose or sheared rivets which goes to prove that the structure cannot be absolutely rigid; and if the rivets completely fill the holes and grip the plates as is claimed for riveted construction (to be a perfect job), what causes the above condition?

Continuity of Construction

Who will dispute the fact that in firebox work, a straight butt weld isn't cheaper, superior, more efficient and economical than a patch inserted with patch bolts? Such a patch properly applied gives one continuous sheet, easier to heat and most of all lessens the probability of becoming mud-burnt, as there is no ledge for anything to settle on. In structural riveted design it isn't possible to obtain a rigidity comparable to a building specially designed for welding. Beams, diagonals, sheets and so forth can be solidly welded at any angle directly to one another, whereas in riveting it is necessary to use angles or gussets, punching numerous holes in beams, thereby weakening them to that extent. Every additional hole weakens the original member, for it is a well-known fact that the more holes and rivets give greater scope for wearing and friction, tending to shear rivets and thereby weaken structure. Very little has been said in the press about the results of the Florida storm on steel buildings, especially with reference to rivet shearing, wind-bracing and the results on same due to the hurricane; but I have been assured by an engineer who visited there shortly after, that some very enlightening information on such subjects could be obtained by a first-hand inspection. No structural designs at present develop the full load equally on all members, as it is admitted that some members have to be made considerably over the necessary strength to compensate for others not so favorably placed.

A great deal of the present wind bracing could be eliminated with welding, not to mention numerous angles, gussets, etc., entailing quite a saving in tonnage, besides the endless punching, shearing and bolting up of shop fabrication.

Riveted design as at present worked out, does not permit of a continuity possible in comparison to welding, nor do the prospects point favorably in that direction, without excessive cost. With welding it is possible to join your members continuously, developing the full strength of the beams with perfect safety, by the use of insert plates, braces and shelf angles.

Design

To try to weld a structure of any kind designed for riveting is fundamentally wrong and therein lies a great deal of the cause for failure in a great many instances. Welding is welding, and likewise with riveting and the only similarity between the two processes, is that they are both metal working industries, futher than that they are as far apart as the poles.

Future of the Art

No one assumes that structures like the Brooklyn Bridge or the Woolworth Building will be put up by welding immediately, as we all know there is considerable ground to be covered. But welding is gaining recognition in spite of all opposition and some failures, through faulty design and workmanship, and it would be a bold individual, indeed, who could predict its ultimate limit.

Several instances have been cited of welding failures on boilers or rather attributed to the fact that welding had been the cause for them. Welding was not properly applied or else should not have been done in the first place; merely a case of poor judgment from those responsible for its application, poor workmanship, or worse still, possible both. In comparison between the two methods, the claim is advanced for riveting that the major part of work is done by machine and nothing is left to the human element. The constant din of air hammers on every structure doesn't verify that. Anyone who has wrecked old structures is well aware of the number of loose, sheared, flared rivets between plates that didn't fill the holes, yet gave excellent service for years, which proves that the factor of safety was certainly ample for the remainder to carry the load.

So why all the doubt and propaganda concerning the unreliability where welding is mentioned?

WELDING VS. RIVETING AT ENGINEERS CLUB

On February 21 the Engineers' Club of Philadelphia, with the cooperation of the Philadelphia Section of the American Welding Society, held a meeting on the subject of "Welding and Riveting as Applied to Structural Steel Members." The attendance, mostly composed of engineers and representatives of the steel fabricators, was estimated at five hundred.

Among the papers on the program were the following: "The Rational Design of Structural Steel Joints for Arc-Welded Connections," by A. M. Candy, Westinghouse Electric & Mfg. Co., Pittsburgh; "This Is the Age of Riveted Steel," by A. F. Jensen, president, Hanna Engineering Works, Chicago; "Arc Welding as Applied to Manufacturing," by J. F. Lincoln, vice-president, Lincoln Electric Co., Cleveland; "The Rivet," by J. C. Hanna, chief engineer, Hanna Engineering Works, Chicago; and "Welding of Structural Steel," by W. J. Warner, General Electric Co., Schenectady, N. Y.

It was freely conceded by both sides that both processes had a place in steel fabrication. Those who spoke for welding admitted freely enough the need for further research in design and even in making of welded structural steel. They were able, however, to show that welding has several marked advantages over riveting, which have not been generally recognized by engineers, and that these advantages are worthy of careful study.

WELDS HOLD WHEN PRESSURE VESSEL IS DESTROYED

An account is given in the February, 1927, issue of Mechanical Engineering of the failure of a welded pressure vessel which was tested to destruction. It was built for 300 pounds working pressure and the size was 5 feet diameter by 43 feet long. The tank was tested under repeated hydrostatic test of 1,000 pounds until the head failed. Many sections of the head and of the tank were subjected to tensile tests and to microscopic and chemical analysis. According to the report made up from these tests the weld metal, which is nickel-steel, shows ample strength and other physical properties. There was no indication of injury to the base metal by the welding operation nor of any difference in the physical properties of the metal in different parts of the head. The welds themselves were of good quality and showed no sign of being affected by the test to which the tank was subjected.

WELDERS MAKE WATER SYSTEMS FROM OLD BOILER TUBES

Among the treasures of the junk pile, waiting to be turned into real money by the ambitious welder, are old boiler tubes. There is an infinite variety of conveniences which can be made from them, and naturally enough they are often made into water systems. Roy Thomas, of Los Angeles, writes that contractors in that vicinity are giving a ten-year guarantee on them. They weld two lengths together and dip them in hot tar at the yard, then haul them out on the job for assembly. According to Mr. Thomas these water systems are giving full satisfaction.

WELDING AN ENGINE WITHOUT DISMANTLING

In the area of the natural gas fields at Weston, West Virginia, there is a large installation of Snow-Worthington engines owned by the Cumberland and Allegheny Gas Company. There have been some breaks to repair and several attempts to get them back into service had been unsuccessful. Finally Mr. R. W. Matthews of the Matthews Welding Company, Washington, D. C., undertook to do the job with the electric arc, without dismantling. This meant moving the equipment from Washington, a distance of 412 miles. But Matthews was equipped with a portable outfit mounted on a truck, so the distance did not bother him. The photograph with the chalk mark shows the cylinder in place with the weld appearing as a direct overhead job. The crack extended from where the waterjacket holds on, the casing being in two halves with a rubber gasket between the cylinder and jacket cover clear through to the exhaust port, allowing water to get into the cylinder and short circuiting the ignition.

The Studding Method Was Used for This Arc Weld in Cast Iron.

The procedure followed on this job was first to dismantle the waterjacket, "V" the crack out at an angle of 45°, put in 14 studs, grind away all foreign substances with an electric grinder, then use an oxy-acetylene torch to heat the casing to a temperature of about 190° at the exhaust port where the cylinder was cracked. The idea in doing this was to prevent any internal strain on the weld after the engine was put back into operation. This work was done with a Todd portable, gasoline driven, 300 ampere machine and the G. E. electrode.

These engines shown in the picture have been in constant service for a period of seventeen years. They are of the tandem type, 4 cylinders on each side, combustion on the front and back of each cylinder. The cylinders are a 36-inch bore with approximately a 4-foot stroke running at 90 revolutions a minute. The total weight of one engine was 395 tons; the weight of a cylinder alone is 17 tons. The cost of a new cylinder at the factory is $6,000; the cost of welding the cracks was $500. Sometime after this work was completed Mr. Matthews received a letter from the plant advising that the job was holding fine with no leakage.

CUTTING METALS UNDER WATER*

By L. F. Hagglund†

BROADLY, the cutting of metals under-water resolves itself into two classes. First, the class of work on which dynamite can be used. Second, the work that must be done by a cutting tool that will not damage adjacent structures and one that will cut along a prescribed line.

The former, or dynamite, jobs consist chiefly of the removal of wrecked steel vessels or isolated metallic submarine structures. For this work where dynamite can be used freely, it is by far the cheaper and most expeditious method. The removal of the wreck of the S.S. "Canadian Recruit" will serve to illustrate an application of the method. S.S. "Canadian Recruit" sank in the St. Lawrence River about 50 miles below Quebec where the river is about 7 miles wide. The wreck was 2½ miles from shore but close to the river channel so that it was a menace to navigation and had to be removed. The Canadian Salvors undertook the work of removal. Accordingly with a small wrecking plant, two divers and a large quantity of dynamite they succeeded during the past summer in practically blowing the wreck to pieces and scattering these pieces so that the required depth of the water was obtained at that location. In this instance nothing was

*Paper read before Meeting of International Acetylene Association, Chicago, November, 1926.

†Under Water Metal Cutting Corporation, New York City.

to be saved. The job was simply one of removal and dynamite did the work. But even for success with this method a diver experienced in the use of dynamite must be obtained and as there are but few divers and a very few who have had experience with explosives, getting the right man is probably the most important part of the job.

For metal that must be cut accurately under-water there has been for years the hacksaw, chisel and drill spurred on by the right hand and arm of a diver or by compressed air. These tools sufficed until the period of the world war.

At that time, 1914-1918, with the increased volume of shipping menaced by an ever increasing number of submarines, wrecks of steel vessels became numerous. Accordingly marine wrecking or salvage received an incentive in this volume of work to develop new and better methods. One need was that for a rapid and reliable under-water metal cutting tool.

The oxy-acetylene torch had come into its own for cutting and welding metals above water and at first efforts were made to adapt this torch for work under-water. Records and reports show that on several jobs fairly good results were obtained in limited depths. In practically all of these cases an ordinary oxy-acetylene torch was used together with some means or apparatus to displace the water from the immediate vicinity of the cutting flame and the metal where it was acting. The difficulties encountered were numerous, the surrounding water pressure, the increase in this hydrostatic pressure with depth. In sea water this amounts to approximately ½ lb. per foot or about 45 lbs. in 100 feet of water. Another difficulty is that at times it is actually impossible for the diver to see what he is doing and he must rely solely on his sense of touch. Aside from these things each job presents its own particular handicaps, a strong tide or river current, extreme cold, the presence of the concrete or heavy paint on the metal, concrete in the interlock of steel piling or a short diving time in great depths. Almost a new problem on every job.

The old Merritt & Chapman Derrick & Wrecking Company in New York understood the problem and looked at it from the diver's viewpoint. One of their men suggested the possibility of using a jet of oxygen upon metal heated by the electric arc under-water. As a marine wrecking company they had a fairly constant though limited demand for such a tool and as a result of this suggestion their own engineers and divers conducted experimental work along this line. They first believed that the heat of the arc alone could be used to cut metal under-water. However owing to the enormous quantity of water in contact with any submerged metal as in this case of a sunken hull, the heat generated by the arc at any one point was rapidly dissipated and the instant the arc was moved away the molten metal solidified usually sodidifying in the cut reuniting the metal. This made it extremely difficult if not impossible to make a continuous cut under-water with the arc alone.

To overcome this difficulty and achieve a continuous cut a jet of oxygen was combined with the arc. A carbon electrode containing several gas tubes was used. Through these tubes oxygen under high pressure was forced directly onto the metal where the arc was drawn.

This combination of the electric arc with oxygen accomplished the desired results. It was possible to cut metal underwater; to cut any metal under-water and at any divable depth. The depth of water does not affect the arc and an increase in depth simply means an increase in pressure at which the oxygen gas is supplied.

Subsequently during the salvage operations conducted on the S.S. St. Paul sunk in New York Harbor in 1918, Ralph E. Chapman and John W. Kirk took out a patent on a method for cutting metals under-water. This method combines the heat of the arc with the oxidizing effect of a stream of oxygen under high pressure.

The under-water metal cutting apparatus consists of a generating unit, switchboard and resistance, a supply of oxygen, oxygen gauge and hose, and the double conductor hose through which both oxygen and electricity are carried to the torch. The torch itself consists of a carbon electrode 12 inches long clamped into a brass holder at one end. Extending through this electrode are two copper tubes at one end, these tubes are also clamped in the brass holder and at the other they terminate at the tip of the electrode.

When the diver strikes an arc under-water with this torch the oxygen is released through the arc and forced upon the molten metal. Cutting starts immediately and the speed possible depends upon the current available and the facility with which the diver can work. And the latter depends upon the job.

In one instance during the early part of this year a quantity of steel sheet piling was to be cut at a depth of 20 feet. When the diver was actually on the job it was found that even in 20 feet of water these steel piles were covered with 12 inches of ice along the desired line cut. This ice had formed when the river was low and remained on the piling when the water rose. It then became necessary to remove this ice before the piling could be reached.

In another instance where only 32 feet of ½ inch steel plate was to be cut it was found that owing to the quantity of mud and silth in the river, the diver was unable to see the work he was doing or even the electric arc itself at any time during the entire operation.

To date steel plate, sheet piling, cast steel, cast iron copper and brass have been cut in depths of water down to 120 feet.

To meet a limited but important demand for under-water metal cutting apparatus complete apparatus and skilled diver operators are carried on hand by the Merritt-Chapman & Scott Corp. and can be furnished on short notice for work anywhere in the United States.

THE CARE OF WELDING HOSE

ANY welding equipment manufacturer will tell you that it is necessary to use a good quality hose, in fact a quality of hose that is made especially for gas welding service, in order to get the best results from the apparatus. The manufacturer, of course, is trying to protect himself against complaints

Fig. 1.

of poor service, which may be due to no fault at all in the design and construction of the apparatus which he sells. There are two important ways in which a poor quality of hose can operate to the disadvantage of the welding torch: first, by clogging the tiny gas passages and valves, and second by developing leaks in service which cause a waste of gas, this undetected waste being erroneously charged as gas consump-

tion. Hose which is so carelessly chosen that it disintegrates in service would naturally be the worst offender because it would cause the most serious degree of clogging in the gas passages. However, there have been found to be grades of hose which, while they did not actually disintegrate, contained a minute film of a dusty deposit called "bloom" on the inside surface. Gases traveling at high velocity through the hose will gradually carry enough of this fine dust into the torch to make noticeable change in the operation of the torch itself. Manufacturers of hose have laid this condition to the use of sulphur in treating the rubber during the process of manufacture, and some manufacturers who have studied this particular problem have devoted considerable attention to production processes which would eliminate the undesirable effects of sulphur curing.

carrier for the gases, is an important part of the equipment and as such deserves careful selection. Then, assuming that a good grade of welding hose is being used in the shop, it follows that some care is necessary to make sure that its quality is preserved as long as possible. In other words, it is only logical that the welder should be warned against needless acts which cause a rapid deterioration in the welding hose and thus set up a condition which may easily be responsible for various kinds of trouble.

In the latest edition of The Welding Encyclopedia can be found the following suggestions for getting the best service from hose and about some of the typical careless acts which shorten its life:

"Two colors of hose are used for gas welding; black for acetylene and red for oxygen. This is to prevent confusion

Fig. 2.

When one who is accustomed to considering rubber hose simply as a carrier for water or other liquids the idea of being careful in the selection of hose for welding may seem to be somewhat far-fetched. An amusing story is told of one purchasing agent who flatly refused to consider an engineer's recommendation that a more expensive grade of hose be provided for his set. The engineer invited the purchasing agent out to the plant and asked him to pick a length of the hose then in use from stock, and hold one end of it up to his eye. When the purchasing agent did this the plant engineer blew sharply into the other end and filled the poor purchasing agent's eye with a cloud of the "bloom" which has just been mentioned. The engineer then proceeded to show that the good quality welding hose did not act in the same way and explained that the dust was just as injurious to the inside of the welding torch as it was to the outside of the eyeball. Thus the question was settled in one plant.

No particular amount of publicity has been given to the subject of quality in welding hose and not much attention has been given to the matter of testing it. But there are several large manufacturers doing national business in rubber hose of various kinds who are able to supply to the trade welding hose of the right characteristics. Durability, of course, is a vrey important consideration because of the extremely rough usage to which the apparatus is sometimes put. For the inside surface a freedom from bloom and a high resistance to the action of the gases used are both necessary, and for the sake of the operator's comfort the hose needs to be as flexible as it can possible be made considering the service which is expected from it.

The subject of quality in welding hose has been mentioned briefly in order to make it clear that the hose, acting as a

when connecting apparatus. See that hose connections are tight. Use a good hose clamp. Both acetylene and oxygen hose should be blown out occasionally so that dirt and dust will not be carried into the torch.

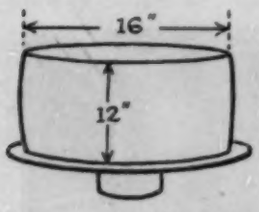
"Welding hose will have much longer life if it is kept safely out of the way of the flame, sparks, or molten metal. The operator should also see to it before he starts welding that he has not left hose where it can be walked upon or run over by trucks while his attention is given to the weld. This is quite likely to happen if extremely long lengths of hose are used. When leaks are found, do not try to repair them with tape, but cut out a section and insert a union, taking care to fasten clamps securely. A backfire which reaches back into the hose ruins it completely, and if it is used for any length of time after such an accident the gas passages in the torch will become wholly or partly clogged with fine particles of the burned lining. Long contact with grease or oil is another common cause of deterioration in welding hose. Careful supervisors know that leaky hose is both dangerous and wasteful, and commonly test all welding hose at regular intervals by immersing it in water while under pressure."

In order to illustrate some of the most common types of careless procedure the accompanying photographs were posed for by a welder of long experience who has had many occasions to caution careless operators who seem to think that rubber hose is made to stand the hardest kinds of abuse and that they cannot get their money's worth out of it without taking pains to give it plenty of abuse. Trouble does not usually result from a single bit of careless handling, but the habit of continually abusing this part of the welding equipment finally results in breaking down the structure much earlier than is necessary. Taking pains to be careful is not a

difficult matter. On the contrary, it is simple and easy. The result is better service from your equipment and that result is very much worth while.

WELDING A BROKEN PULLEY

The sketch shows a belt and clutch pulley from a Case 22-40 horsepower tractor. It broke in three spokes, a, b and c. In chipping a V and drilling holes designated by 1-2-3, we broke the remaining spoke, d, which, by the way, was partially cracked. In the holes, 1-2-3, bolts were inserted holding the parts in place and then a temporary furnace, made of ordinary bricks, and a sack of charcoal poured around the pulley causing an even dull



red heat. This furnace, if I may call it such, was covered with asbestos paper and the breaks welded through a hole in the paper. Then it was turned over and the reverse side welded. A little more charcoal was added and let remain for a half day, resulting in a first-class weld. These jobs don't come in bunches. The rim of the pulley is over ¼ inch thick and the spokes about an inch thick.

Karl Bayer.

FIRE DAMP DETECTOR

A recently invented electrical detector of "fire damp" or methane, the combustible gas which is responsible for most coal mine explosions, has been called the most important forward safety step in the 20th century, and is expected by mine operators to put an end to much of the tremendous loss of human life in coal mine disasters.

The apparatus has been developed through cooperative research work instigated by coal mine operators and State legislators of Utah, who are using every possible means to put an end to suffering caused by past coal mine explosions in that

Safety Device Developed in Union Carbide Laboratories.

State. Among the organizations which offered their services for this endeavor was the Union Carbide and Carbon Corporation. At its Long Island City Laboratories a group of men, led by Mr. E. K. Judd, has been working for two years on the idea that since combustible gas is the cause of the explosions, an automatic, accurate, and rugged detector of combustible gas would be the best possible means with which to avoid the disastrous explosions.

Its basis is a platinum coil, about an inch long and five thousandths of an inch in diameter. When such a filament is heated to a constant temperature, it becomes slightly hotter in the presence of methane or other hydrocarbon gas. The more methane, the hotter the platinum coil gets. It is secured at the end of a stick and connected with a portable storage battery which heats it. The current from the battery is maintained constantly by a simple automatic control, so any variation in the temperature of the coil is caused by the combustion of methane at the surface of the wire.

The temperature of the coil is then shown on a dial indicator, which is so calibrated to register the amount of methane in the atmsophere around the coil. In order to prevent an explosio,n, the coil is protected by the same gauze bonnets developed for a safety lamp a century ago by Sir Humphrey Davy.

Since it can be attached to a telescopic stick of any length, this sensitive instrument can be poked into the highest crevice on a mine level. The wires connecting it to the battery and indicator, of course, can be of any desired length. The battery and indicator are carried on the fire boss's belt. Indicators permanently placed in the entries would be wired to a recording device in the mine office, and could be made to ring warning signals, when the gas content rises above a safe point.

While the indicator registers immediately the presence of an increasing amount of methane in a steady action of the needle, if there is five per cent methane in the air (the danger point), the needle will swing back and forth rapidly.

The detector has met with unvarying success in both laboratory and field tests. Mr. Judd lately spent some time in the anthracite coal regions of Pennsylvania where he delighted coal mine operators and others concerned with the problem by demonstrating its accuracy and quick action. Further demonstrations were held in Utah during the first of February.

FALL EXPOSITION OF A.W.S.

The Exposition Company of the American Welding Society, with the approval of the Executive Committee, has effected arrangements for holding the 1927 Fall Meeting Exposition jointly with that of the American Society for Steel Treating at Detroit, September 19th to September 23rd, inclusive. It is believed that this departure from the previous custom of operating the exposition through the local sections will receive general approval.

There are many advantages to this plan. Among those which will appeal particularly to the exhibitors are:

1. A large number of visitors. While the A.W.S. will have its own section of the Convention Hall, it will be a part of one of the largest expositions which is held annually in this country. The number of visitors will be several times what could possibly be expected to a separate exposition. For instance, at the last exposition of the A.S.S.T. at Chicago about 60,000 sq. ft. of space was occupied by 300 exhibitors and was attended by 80,000 visitors. While the Chicago Exposition was somewhat larger than is to be expected at Detroit, past records and the advance sale of the A.S.S.T. space (over 50 per cent has already been engaged) would amply justify the prediction that they will have 300 exhibitors occupying 100,000 sq. ft. of space and that from 75,000 to 100,000 visitors may be expected.

2. The A.S.S.T. Exposition covers practically the entire working field. Visitors are, therefore, the particular class to which welding exhibitors wish to appeal, namely, the responsible men in the various metal fabricating industries. In other words, the total number of visitors will not only be very large, but the average "quality" will be high.

3. Many of the members have heretofore exhibited at both the A.S.S.T. Exposition and the A.W.S. Exposition. This new plan will particularly appeal to such members, for it will obviously mean a considerable saving.

NEW CATALOG OF NATIONAL EQUIPMENT

The National Cutting and Welding Equipment Company, 223 Main Street, San Francisco, have recently issued a new catalog of oxy-acetylene equipment and supplies. It contains 48 pages, printed in two colors and strongly bound in a cardboard cover.

NEW WELDING MOVIES SHOWN AT CLEVELAND

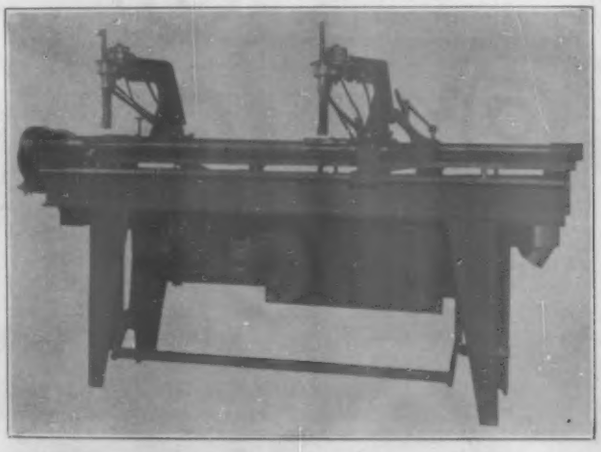
At the regular meeting of the American Welding Society, Cleveland Section, held February 24th, J. B. Green, president of the Chicago Steel and Wire Company, Chicago, Ill., was the speaker of the evening. Mr. Green presented two reels of motion pictures, one showing the essential steps in the production of welding rod, and another showing what actually takes place when the welding rod is melted and fused to the work piece by the torch or the arc. These close-up views of the arc and torch in action were taken by the slow motion process, and with a special film, which is affected only by the infra-red light. By slowing up the operation and eliminating the glare, the transfer of metal becomes easily observed. Then by changing the welding rod, the picture shows the effects of various welding rod properties.

NASHVILLE TO HAVE WELDING SCHOOL

The Nashville Auto School, Nashville, Tenn., is establishing a school for training oxy-acetylene welders. A special training shop is being equipped and a suitable course of lectures and practical work outlined which will enable them to turn out creditable operators. The school will be widely advertised so that its services will be known to both employers and prospective students of the process.

NEW BUTT WELDING MACHINE OPERATES WITH CARBON ARC PROCESS

Among the many types of welding equipment which have been brought out in recent months, the "Automatic" machines for electric arc welding are certainly holding interest. It was only a few years ago that everyone was agreed that electric arc welding would forever remain a manual process in which the skill of the operator would be the limiting factor. Yet in the last twelve months numerous new machines have appeared on the market for doing welding by machine which had formerly been done by hand.



Lincoln Automatic Butt Welder.

The Lincoln Butt Welding Machine illustrated is a further development of the machine driven carbon arc to the problems of welding. One ordinarily thinks of butt welding in terms of the resistance welder. The arc butt welder is not an alternative method of doing butt welding, but is claimed to be a solution to a class of butt welding problems which the resistance welder cannot solve. As an instance of this, a plug may be welded into the end of a tube with the arc butt welder. The machine illustrated welds both ends of the tube at once by use of the two automatic heads. A similar instance of applicability of the arc butt welder is that of welding a small diameter round bar to a large diameter bar. With the arc butt welder, the welding heat is applied to the joint by the carbon arc and the bars revolved to distribute the heat uniformly. Pressure is applied to squeeze out the slag and complete fusion.

Use of the arc butt welder does not involve difficulties with power supply. The motor generator set used to supply current for the arc supplies direct current at 40 to 60 volts. The motor is a standard induction motor and does not take a special power rate.

TWO G.P.A. FILMS NOW AVAILABLE

G.P.A. Film No. 1 "The Magic Flame."

This film illustrates the efforts of mankind since prehistoric days to join metals together. It shows a caveman trying to fasten two pieces of metal together, then shows the old blacksmith shop and the latter day riveter, and then the present day welding process. It shows how the oxy-acetylene flame is produced and its various uses for welding and cutting different pieces ranging from the soldering of tiny radio condensers to the cutting of 18-inch risers from 15-ton castings.

An Exciting Moment in the G. P. A. Film.

G.P.A. Film No. 2 "The Magic Flame."

Morgan and son run an old-time repair shop. Dad Morgan believes that grandfather's methods are good enough for him and refuses to put in new equipment. Jim, his son, is progressive and when Dad is taken sick, Jim puts in a welding outfit. The picture shows how the business increases and gives illustrations of the various types of repair jobs which can be done with the oxy-acetylene torch.

Any user of welding equipment or anyone interested in the process who wishes to obtain these films to run in local theaters or for a group of any kind can obtain full information by writing to the Gas Products Association, 140 S. Dearborn St., Chicago, Ill. The Association will then get in touch with the nearest member who will arrange to have a representative take charge of the exhibition.

The photograph is a scene from the "Magic Flame" G.P.A. No. 2, in which Dad Morgan is showing anger toward Jim's sweetheart for suggesting that he get Jim a welding outfit.

HARRIS CALORIFIC CO. ISSUES SUPPLEMENT TO CATALOG

During the months prior to April, 1926, the Harris Calorific Company, Cleveland, Ohio, prepared and had printed the tenth edition of its catalog. Subsequently negotiations were completed by virtue of which a merger was effected between the Harris Calorific Company and the United States Welding Company of Minneapolis, Minn., and the consolidation took place April 1, 1926. The plant at Minneapolis was closed and all plant equipment and managing personnel were transferred to Cleveland. It was thought best, under the circumstances, to issue, in supplementary form, a concise catalog of those products formerly manufactured by the United States Welding Company, which it is the intention of the Harris Calorific Company to continue in production. The new supplement contains thirty-six pages, with a

strong cover, and lists torches, regulators, acetylene generators, valves, manifolds, gauges; gasavers, complete welding and cutting outfit, and accessories. The foreword in the catalog makes especial mention of the completeness of the line, since the Harris line formerly contained so many cutting torches for use with fuel gases other than acetylene, and the U. S. line specialized in oxy-acetylene apparatus.

A NEW 3-IN-1 PAINT SPRAY

The spray gun is becoming the universal tool used in coating any surface with paint, varnish, enamel, lacquer, etc. The great savings in time, material and labor which are possible with the use of efficient spray equipment, stamp this process as the modern method of painting.

The Alexander Milburn Company, Baltimore, Maryland, has developed a 3-in-1 spray gun which is adaptable to very fine work such as painting and lacquering automobiles, furniture, etc., or on coarse operations such as painting machinery, freight cars, etc.

This is a triple purpose gun for use either as a siphon-feed, pressure-feed, or gravity-feed spray. It is immediately adaptable to use by either method, whichever may be more convenient for the work.

Milburn Spray Gun.

The scientific construction of this gun allows it be to used on low pressure or with an "ordinary garage compressor".

Consistent with the kinds of work encountered, the Milburn multiple-head adjustment permits either a flat, fan spray in either horizontal or vertical position or a round spray by a mere adjustment. The atomization is so fine and even that "orange-peel" is eliminated, minimizing sanding and rubbing. The Milburn spray can be so finely adjusted that it can be used for touching up, shading and high lighting. An air pocket, formed by the fan-shaped nozzle, completely surrounds the atomized spray and lessens the loss of material through evaporation and utilizes the entire spray in thoroughly covering the surface. When dusting is desired, a trip lever is raised, allowing the air only to function and completely shutting off the paint supply.

Both the air and paint valves are operated simultaneously. By pulling the trigger paint flows to the atomizing chamber, is expanded and driven with ample force into the pores of the surface to be covered. Daubing and brush marks are eliminated.

TO ENLARGE STOODY PLANT

In order to meet properly the demands of its rapidly developing business, the Stoody Welding Company, Slauson Boulevard, Whittier, California, has announced through its president, W. F. Stoody, immediate plans for enlargement of the present plant, the contract for a new steel-frame addition having already been awarded to the Union Iron Works of Los Angeles. Stoody's present plant of the sawtooth-roof, steel-frame type, was completed only last June, and has a floor area of 14,000 square feet, but has proven inadequate to the needs of the concern. The planned addition consists of a building of the same type covering a ground area 80 by 20 feet.

The Stoody Welding Company has shown remarkable growth, beginning as a small welding and repair shop in the oil fields in the Whittier district. During the six years of its life it has expanded until now it markets its products, welding rods and welding equipment, in national markets.

1927 "STABLE-ARC" WELDER INSTRUCTION MANUAL

The Lincoln Electric Company of Cleveland has just issued the 1927 edition of the "Instruction Manual". This publication, which is revised annually to cover the latest practices used in manual electric arc welding, is of interest to practically everyone who uses arc welding. Among the subjects treated are: High speed steel welding, high pressure pipe welding, automobile frames, boiler repairs, welding cast iron, manganese steel welding, carbon arc welding, manufacture of machinery and equipment using welded steel in place of casting. Price, $1.00.

AIRCO BOOKLET ON OXYGEN MANIFOLDS

Pipe line distribution of oxygen and acetylene is becoming more and more common as industrial plants, railroad shops and other large users of the welding and cutting processes realize the advantages of distributing these gases through pipe lines to welding and cutting stations. Constant supply of gases under controlled pipe line pressure is assured, and the labor and expense of distribution and collection of cylinders in the plant is eliminated. Catalog Section No. 6, just published by the Air Reduction Sales Company, New York, describes manifolds for any number of cylinders desired, the construction being standardized, so that manifolds of large capacity can be made up on short notice.

UNA WELDING ROD BULLETIN

Bulletin No. 119, just issued by the Una Welding and Bonding Company, Cleveland, Ohio, is a four-page folder listing a line of six coated ferrous rods and three non-ferrous rods. Complete information regarding sizes, uses, nature of weld metal, coating, current required, is given for each rod. This information is preceded by an interesting discussion of the metallic arc welding process with special reference to the importance of the electrode material used. The functions of the flux coating are discussed in detail, and the theory is advanced that coatings are a more practical way of improving the weld than the use of expensive alloy rods. Copies of this bulletin may be obtained by writing the Una Welding and Bonding Company.

RENTAL SERVICE ON ARC WELDERS

The Goodman Electric Machinery Company of Newark, N. J., have recently been able to expand their rental service on Electric Welding Machines due to an increased number of machines in stock.

At present motor generator set welders, transformer welders and gasoline engine driven welders can be furnished on rental the same day instructions are received.

GEWE FOLDER ON CITY GAS EQUIPMENT

The General Welding and Equipment Company, Boston, Mass., are using an illustrated letter to feature the use of city gas for cutting and heating. The letter shows the uses and economic advantages of city gas, and gives drawing and details of an automatic gas boosting unit to furnish city gas at fifty pounds pressure.

Returned to Service at minimum cost in time and labor

TOBIN Bronze Welding by the oxy-acetylene process made it possible to return this cracked engine casting to service as strong as ever in two hours and a half.

Because Tobin Bronze flows freely at 1650°F., complete dismantling for preheating in a furnace was unnecessary. The low temperature used also prevented distortion of the casting.

The great strength of the welds, together with the saving in time effected by the elimination of extensive preheating, makes Tobin Bronze Welding the logical method for many production operations as well as for repairs.

Tobin Bronze, manufactured exclusively by The American Brass Company, may be obtained from leading distributors of welding equipment and supplies.

THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LIMITED, New Toronto, Ont.

Cracked engine casting in position for Tobin Bronze Welding.

As repaired with Tobin Bronze by the Oxy-Acetylene Process.

TOBIN BRONZE

REGISTERED U.S. PATENT OFFICE

WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT

NEW WELDING COMPANY ORGANIZED AT MIDDLETOWN, OHIO

The United Welding Company is a new organization just incorporated at Middletown, Ohio, by W. W. Petry, W. R. Crane and C. W. Shartle, Jr.

Mr. Petry is a welding engineer widely known among the profession. He has been a frequent contributor of articles on welding and has been active in association work. For several years he was in charge of welding for The American Rolling Mill Company, and also served as consultant for the clients of that company.

Mr. Crane has also been connected for many years with the sales division of The American Rolling Mill Company. He will be in charge of all sales work for the new corporation.

Mr. Shartle has had a long business experience with the Shartle Brothers Machine Shop, of Middletown.

The United Welding Company purchased the assets of the C. C. Fouts Company, and is now open for general contracting of welding, welded sheet metal products, and welding engineering services.

NEWS OF THE WELDING TRADE

James E. Ferguson Company, Buffalo, N. Y., distributors of Jefco Welding Rods, owing to increased business, have moved to larger and more centrally located headquarters at 1597 Main Street, of that city.

W. A. Slack, President of the Torchweld Equipment Company, has been on an extended business trip through the West and along the Pacific Coast during the past five weeks.

E. D. Giberson & Co., Inc., 40 Rector Street, New York City, announce that they have placed on the market, under the name of "Excelo," gas and electric welding wire, a grade of uncoated electric welding rod, and also copper-coated rods for oxy-acetylene welding The wire is drawn in all standard sizes, at the company's mills. Sales are under supervision of the company's wire department.

Brown Brothers Welding Company, San Francisco, California are at present welding a single story building 300 ft. by 300 ft., having 50 to 60 ft. roof trusses. This is to be a completely welded building.

Standard Steel and Wire Company, Greensburg, Pa., makers of Standard gas and electric welding wire, announce that they are now equipped to fill orders from all parts of the United States. The company's own mills at Bolivar, Pa., are exclusively engaged in the production of this wire. Samples of various grades can be secured upon request.

Welding Service Company, 50 Church Street, New York City, announces that it is carrying in stock for immediate delivery the new General Electric Company type F Electrode, for welding steel, for distribution in New York, New Jersey, Connecticut, west of New Haven and Hartford, and Erie County, Pennsylvania.

The Linde Air Products Co., 30 E. 42nd St., New York City, are planning the construction of a plant at Duluth, Minnesota, and also a new plant at Houston, Texas.

The General Welding and Equipment Company, Boston, Mass., announce automatic gas boosting units, furnishing automatically 50 lbs. pressure, for installation where it is desired to use city gas for cutting.

STEEL FLOORING OF WELDED CONSTRUCTION

In addition to non-slip surface, one-piece welded construction, self-cleaning, completeness of protection by painting and galvanizing and high lighting efficiency are features stressed in connection with new steel grating and flooring being placed on the market by the Blaw-Knox Co., Pittsburgh.

This grating, named Security, is manufactured by the resistance welding process, the longitudinal and cross bars being welded into a one-piece construction. The absence of slots and rivet holes is claimed to permit of utilizing the full strength of the material and to eliminate play or rattling of any section of the grating.

The grating contains 11 longitudinal bars to the foot, these bars being ⅛ to ⅞-inch thick, as required. The cross bars at the top are spaced on 2½-inch centers. Thickness spacing and depth of bars can be modified.

The company's steel steps, made on the same principle as the grating, are welded throughout and can be made in any size required. To make the outer edge of the steel step doubly visible, an additional set of cross bars is welded between the two outer longitudinal bars. These extra bars are stressed as adding to the non-slip feature.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.

Jobs Wanted—4 lines free.

Other Ads—$1.00 per line, minimum 4 lines.

Counted 8 words to line. Add 6 words for keyed address.

Wanted—Live and competent welding equipment salesman. Give full details of experience and qualifications. Address L. L. Nelms, care Brazelton, Wessendorf & Nelms, 317 Preston Avenue, Houston, Texas.

Position Wanted—Acetylene welder of wide experience also instructor, desires connection with a welding supply house. Have experience as service man. Best references. Address 110, care The Welding Engineer.

Position Wanted—First class Oxy-Acetylene welder would like to connect with good shop, or manufacturer, as working foreman welder on general production. D. Randall, 223 Pulaski St., Brooklyn, N. Y.

Wanted at Once—Electric Welder—thoroughly experienced with use of G. E. arc welding machine, particularly for welding structural steel. In replying, outline your experience and state salary desired and whether married or not. Manchester Engineering & Welding Co., P. O. Box 327, Manchester, New Hampshire.

Wanted—The address of every gas and electric welder in the United States. Send them to Knight Brothers, 113 S. Oakley St., Chicago, Ill.

For Sale—Service rights on WK and WC Prest-O-Lite cylinders, large or small quantities. Alfred E. Corp, 40 Mathesson St., Providence, R. I.

Position Wanted—Oxy-Acetylene welder, six years' experience; also worked as mechanic. Position with future preferred. Address 111, care The Welding Engineer.

For Sale—New Acetylene generator in A-1 condition offered at a bargain to anyone who can use it. Address 112, care The Welding Engineer.

Wanted—The address of Harry Love, welder. He will learn something to his advantage by addressing Box M, care The Welding Engineer.

WHARTON

Standard Seamless Steel Cylinders

for—

OXYGEN
HYDROGEN
LIQUEFIED PETROLEUM GAS

Interstate Commerce Commission Specifications

WILLIAM WHARTON JR. & CO., Inc.
EASTON, PENNA.

Prices below Value

on New G. E. Arc Welders

Generator wound 75/300 amperes, 40/20 volts, Motors wound 10 H.P., 220 volts, 3 phase, 60 cycles, also 220 volts, direct current.

General Electric Co. New Type F Electrodes carried in stock for immediate delivery.

WELDING SERVICE CO. 50 Church St. New York

Prepare the Work and Smooth the Welds with

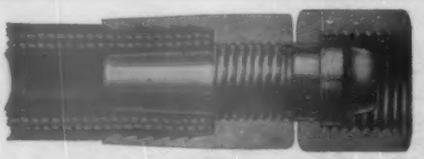
MALL

Portable Electric and Flexible Shaft Tools and Grinders

MANY TYPES AND SIZES

MALL TOOL CO.

8385 S. Chicago Ave. Chicago, Ill.



NORGREN
ACETYLENE HOSE COUPLING

Standard 9/16x18, right and left hand thread
LONG LIFE AND SAFETY
List Price All Sizes, $1.00
Write for literature and discounts

CARL A. NORGREN CO.
1157 CALIFORNIA ST., DENVER, COLORADO

"STANDARD" Welding Wire
GAS AND ELECTRIC

for sound permanent welds : : lower costs—everlasting satisfaction

Made in our own mills by specialists in welding wire manufacture
A grade for each type of work—send for samples.

Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

Why the Combination Drill and Grinder?

BECAUSE:

1. The price of one tool pays for two.
2. It performs on both jobs perfectly.
3. You can take it to the job and it works in any position.
4. It's a WODACK tool. That means quality.

We would like to send you a copy of "Electric Tool Facts."

Wodack Electric Tool Corporation
43 S. JEFFERSON ST., CHICAGO, ILL.

"WODACK" Combination Portable Electric Drill and Grinder Patented Nov. 1, 1921

HOLLUP
Welding Wire and Supplies
Are Uniform

Out of nearly two million pounds of Hollup Welding Wire shipped during 1926 not one pound was returned because of unsatisfactory performance.

Wanamaker Coated Electrodes
Rex Processed Bare Electrodes
Rex Oxy Acetylene Welding Rods
Rex Welding Accessories

Write us for samples and literature

C. H. HOLLUP CORPORATION

3335 W. 48th Place **CHICAGO, ILL.**

A NEW TORCHWELD WELDING TORCH AT A POPULAR PRICE

No. 22 NEVER FLASH

A Triumph in light torch construction

Torchweld has just developed a light, perfectly balanced torch for average production and repair work. The one piece tip eliminates chances for gas leaks, and repair bills. Every permanent joint is brazed and every valve is accurately machined to assure absolute tightness. It produces an unchanging, soft, neutral flame for continuous service, and it cannot flash back. Let us send complete details.

22NF TORCH COMPLETE AS SHOWN $25

Complete 22NF Unit Including 2 Regulators, Hose and Accessories $75

TORCHWELD EQUIPMENT CO.
224 N. Carpenter St., Chicago

When buying CARBIDE — Ask for NATIONAL

BEST for All Industrial Purposes

—

IN THE RED DRUM SAVES YOU MONEY

—

Warehouses in All the Principal Cities

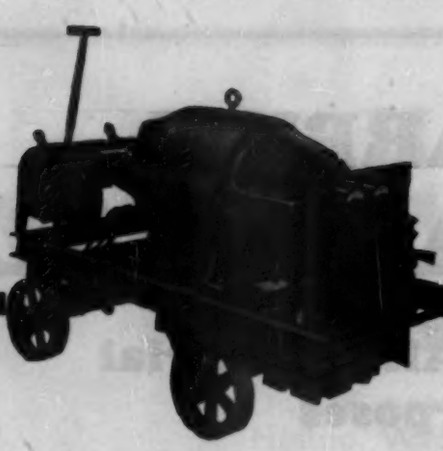
National Carbide Sales Corporation, 342 Madison Ave., N. Y.

Roebling
Welding Wire

is uniform in quality throughout the same shipment and throughout all shipments. It is giving utmost satisfaction wherever used and is guaranteed to make perfect welds with the least amount of trouble in welding.

Low Carbon—
Standard High Carbon—
Special High Carbon—
Special High Manganese—
Gas Welding Wire

John A. Roebling's Sons Company
TRENTON, NEW JERSEY



Welding Operators Know the Difference

the moment they strike an arc with this Una Welder. There is a drive and stability behind the Una arc that makes welding easy, that speeds up welding with plenty of heat for good penetration and thorough welding.

With a current range of 75 to 450 amperes the welding operator can tackle any job from thin steel sections to heavy structural steels and castings.

Una Welders are adaptable for either carbon arc or metal arc welding, depending on the job.

Compact, rugged, portable and light in weight these welders can be moved to the job if necessary.

Una Welders are made in two types;

Type A 3..... 75 to 300 amperes
Type A 4.....100 to 450 amperes

Una Welding Rods

Good welding Rods are economical. Una coated rods for ferrous and non-ferrous metals not only increase the speed of welding but also make better welds because the metal flows more freely and its physical properties can be controlled to approximate those of the parent metal.

Send for Bulletin No. 119

UNA WELDING & BONDING COMPANY
1615 COLLAMER AVENUE
CLEVELAND, OHIO

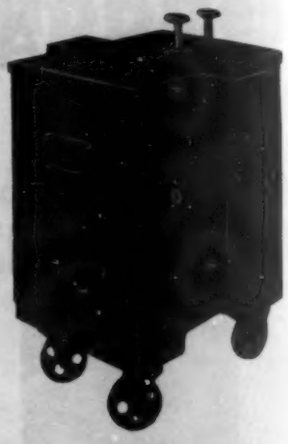
UNA Welders Welding Rods

Small Shops Grow Into Big Shops

by using the

NEW IMPROVED

SENECA Electric ARC WELDER



The low operating cost of arc welding doubles profits even when prices are reduced. Put a Seneca Arc Welder, to work in your shop and you'll soon learn what a profit can be made in your business. Don't worry about the cost—our convenient terms take care of that problem. Write for details of our plans.

Seneca Electric Arc Welder Co.
Seneca, Kansas

Gas SEACO Arc

TRADE MARK

Welding Rods

are given the same care in processing and inspection as

Seaco Tool Steels

Samples on Request

"It isn't only the analysis that counts!"

STULZ-SICKLES CO.
IRON & STEEL PRODUCTS
Tool Steel and Welding Rods

Immediate Shipment From Cleveland and Newark Warehouses

125 LAFAYETTE ST.
NEWARK, N. J.

Uniform Quality Assured

WELDERS who use Commercial Acetylene soon learn that every cylinder contains the same pure gas.

Your torch can tell the difference!

COMMERCIAL ACETYLENE
Means pure acetylene.

COMMERCIAL SERVICE
Means prompt service.

No matter what your gas requirements may be you will be interested in our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30-in. size	125 cu. ft. cap.
12x36-in. size	225 cu. ft. cap.
12x44-in. size	275 cu. ft. cap.

Commercial Acetylene Supply Company, Inc.

General Office: 80 Broadway
New York City

BRANCHES:

900 W. Jackson Blvd. Chicago, Ill.
683 Atlantic Ave. Boston, Mass.
612 Trust Co. of Georgia Bldg. Atlanta, Ga.
417 Market Street San Francisco, Calif.

OXECO

Seamless Monolithic filled acetylene cylinders have successfully undergone practically every conceivable kind of a test in actual service. The result has always been the same, namely, 100% safety.

The truly seamless shell made entirely from one piece of carefully selected steel always will remain in one piece regardless of heat, pressure or other conditions.

Monolithic filler with a crushing strength of several hundred pounds per square inch cannot weaken, sag or deteriorate.

Leading acetylene producers and many acetylene users who have investigated the matter of cylinder construction now ***specify seamless monolithic filled acetylene cylinders.***

KEITH DUNHAM COMPANY

110 South Dearborn Street
CHICAGO, ILL.

"Another Federal Production Welder"

Our Latest Type of Valve Stem Welder

A single purpose machine for welding cast iron heads to steel stems at the amazing rate of 4000 per day.

You will find welding output on butt, spot and seam welding operation will reach the highest figures consonant with low cost when Federal Electric Welders are used. This may necessitate a specialized welder or a more versatile one. It depends upon your production schedule.

We produce all types of electric spot, butt and seam welders, standard or special, whichever is desired.

Offices in all the large cities and if not listed in your telephone directory, write us direct.

Federal

Machine & Welder Co.
WARREN, OHIO
U. S. A.

Recognized leaders in development and construction of special welders of all types.

Dixon's Graphite Rods and Plates for Welding

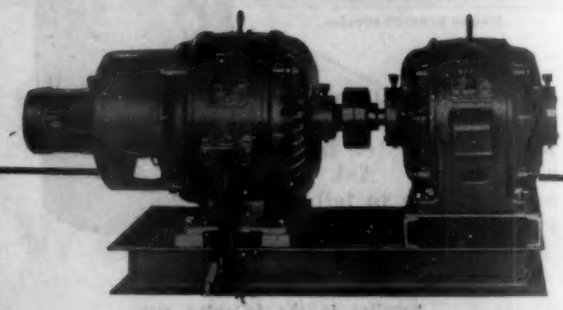
Made in all diameters, lengths and sizes.

Small diameter rods are sold in 4, 6 and 8 inch lengths, the shorter the rod the less breakage in shipping.

Also Dixon's Graphite Welding Putty. In 5 and 10 lb. cans.

Dept. 202A.

Joseph Dixon Crucible Co.
JERSEY CITY, N. J.
1827— ONE HUNDREDTH ANNIVERSARY—1927



You Can Depend on the Rating of the

HANSEN
ARC WELDER

It will operate continuously throughout the day, at full capacity, without distress and with uniform results. The rated capacity of the HANSEN Arc Welder is by no means its limit. If you want to use that current all the time, this machine will give it to you. When you buy the HANSEN, you get what you pay for.

NORTHWESTERN MFG. CO.
Clinton and Madison St. Milwaukee, Wis.

"Here is wire you can *depend upon*"

Experience has taught thousands of welders to look upon Page quality as a matter of course—something to be depended upon at all times. They know that when they choose a particular wire or electrode to do a certain job—that it will produce a weld of similar properties to the base metal, lower production costs and eliminate spoiled work.

The reason lies in the Page process of manufacture. First, all raw material is analyzed to assure uniformity. Second: All Page wire and electrodes are processed to meet the exact requirements of the work to which they will be placed. Third: They are shop tested to assure working qualities under actual job conditions. Fourth: Each piece is plainly marked for identification.

Prove these facts for yourself. Write today for a sample of wire and further information. No obligation.

Page Steel and Wire Company
An Associate Company of the American Chain Co., Incorporated
Bridgeport Connecticut
District Sales Offices:
Chicago, New York, Pittsburgh, San Francisco

PAGE-ARMCO
PROCESSED
Welding Wire *and* Electrodes

Imperial

For Every Oxy-Acetylene Welding and Cutting Job

There is an Imperial Outfit for every operation for which the Oxy-Acetylene process is adapted. Whatever the requirements of your shop may be, there is an Imperial Outfit to meet them. Light equipment for light work—heavy duty equipment for heavy work—outfits for welding only or for both welding and cutting—all these, and others, are fully described in our new catalog. Imperial equipment has won wide favor in factories, shops and mills because of its dependability and because it produces better work.

The No. 11 Imperial Welding Outfit shown here, includes the new Type X Imperial Welding Torch and comes packed in a steel carrying case. The price of this outfit is $90.

Save 2 to 5 Cents per Cubic Foot of Acetylene

The Imperial Acetylene Generator provides a constant supply of pure acetylene gas at a saving of 2 to 5 cents per cubic foot over gas compressed in cylinders. Approved by the Underwriters Laboratories. No weights, pulleys or motors. Send for complete description.

Send for New Complete Catalog

THE IMPERIAL BRASS MFG. CO.
522 So. Racine Ave., Chicago

Weldite

Welding Rod

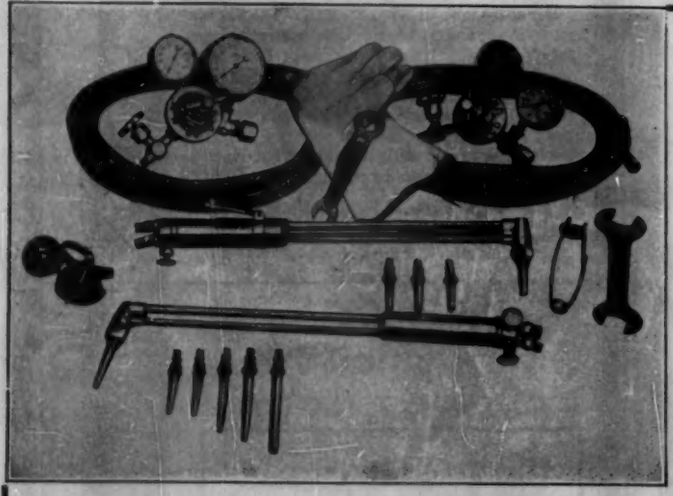
Weldite G—No. 6 Coppered Finish for gas welding lays the metal down quietly, free from boiling, free from surface scum and floating white specks. The metal settles instantly when the torch is removed.

Weldite E—No. 18 Green Surfaced for electric welding is the smoothest running electrode ever offered users of welding. Sold at the price of bare electrodes.

Products of the Research Department

CHICAGO STEEL & WIRE CO

103rd Street *and* Torrence Avenue CHICAGO



K-G WELDING and Cutting Torches are guaranteed to be absolutely free from back-flashing. Simple and scientific construction makes this possible at a reasonable cost. Perfect fitting tips and smooth operation conserve gas and time. A K-G Torch will increase your respect for the oxy-acetylene process.

Have a K-G Outfit Ready for the Next Break.

BECAUSE breakdowns are not made to order you cannot tell how large or how small the next one will be. You do know that you must be prepared to repair it immediately or lose money while you wait for new equipment. This complete K-G unit for welding and cutting is your insurance against long shut-downs. Its range of service is so complete that you can depend upon it for every job.

K-G WELDING & CUTTING CO.
515 West 29th St.,
New York City

Distributors in principal cities

K-G

If you dig into facts you will find

lives up to its slogan "More Gas per Pound"—

SHAWINIGAN PRODUCTS CORPORATION · NEW YORK · Plants · Shawinigan Falls, Quebec, · Keokuk, Iowa.

AUTOMOBILE WELDING WITH THE OXY-ACETYLENE FLAME

By M. KEITH DUNHAM

EXPLAINS in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone.

Gives principles never to be forgotten. Aluminum, cast iron, steel, copper, brass, bronze and malleable iron are fully treated, as well as a clear explanation of the proper manner to burn the carbon out of the combustion head.

AUTOMOBILE OWNERS, GARAGE AND SERVICE STATIONS, BLACKSMITHS AND MACHINE SHOPS, as well as industries using the oxy-acetylene flame, will find this book of the utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them.

167 Pages
CLOTH BOUND
Price
$1.50

THE WELDING ENGINEER
608 S. DEARBORN ST. CHICAGO, ILL.

Burke Arc Welders

Single Operator and Two Operator Machines

for electric motor, gasoline engine or belt drive and for either stationary or portable service

Ask for Bulletin 133

Burke Electric Company
Erie, Pa.

SALES OFFICES
Buffalo Chicago Cleveland Detroit
New York Philadelphia Pittsburgh

SALES AGENCIES
Akron: Berthold Electric & Engineering Co.
Boston: C. A. Cotton
Cincinnati: Underwood Electric Co.
Indianapolis: W. C. Fletcher Co.
Minneapolis: H. C. Lemire
Kansas City: W. T. Osborn
Milwaukee: Fred H. Derner
St. Louis: Louis D. Moore
Troy, N. Y.: E. I. Van Doren
Tulsa: The Cost Cutting Co.

IDEAL FACE SHIELDS

Ideal Face Shields protect the head, chest and neck against direct and reflected rays. Easily adjusted and removed. Constructed of vulcanized fibre and aluminum, assuring durability and lightness. Hinged door allows quick inspection of work or interchange of glasses.

IDEAL WELDING GLOVE

The Ideal Glove for Electric and Acetylene Welders is made from Sheep Skin, which has been Subjected to an Asbestos Treatment and which makes it both heat resisting and fireproof.

IDEAL WELDING APRON

The Ideal Apron for Welders is made of leather which has been especially treated to stand the heat, and at the same time be very flexible and durable.

THE IDEAL FACE SHIELD CO.
468 N. Garfield Ave.,
COLUMBUS, OHIO

NOW READY!

WILLSON-WELD

TRADE MARK REG.

The most protective type of welding glass ever offered. Guaranteed to cut out over 99% of the harmful rays.

No. L11. Willson Bakelite Welding Goggle with Willson-Weld Glass. Per doz $43.20

No. L81. Willson Strong Fibre Welding Goggle with Willson-Weld Glass. Per doz $36.00

Willson Helmets and Handshields also equipped with Willson-Weld Glass. Ask for further particulars.

WILLSON GOGGLES, Inc.
Reading, Pa.

SPOT

SEAM

ARC

For Production
Electric Welding
Machines

Gibb Welding Machines Company
Bay City, Michigan
New York—Philadelphia—Cleveland—Cincinnati—Detroit—Chicago—St. Louis—Los Angeles—Toronto—Montreal

Big Industries are using the

WELDENE PROCESS

Arc welds on cast iron can be made water tight by using WELDENE wherever porous spots occur. Foundries using the arc to repair spongy spots in castings find that WELDENE makes every job a success.

WELDENE is non porous.

If you are having trouble with cast iron welds, all you need is WELDENE. Ask your dealer, or write us direct.

The Weldene Corporation
608 S. Dearborn St.
Chicago, Ill.

INDUSTRIAL GASES

OXYGEN HYDROGEN
ACETYLENE NITROGEN

ALSO GENERATING APPARATUS

Cylinders—Valves—Regulators
Eyosee and International Welding and Cutting Torches
Welding Wire—Fluxes
Cast-iron and Aluminum Rods
Plain and Armored Rubber Hose
Asbestos Pads and Paper Goggles, etc.

All equipment fully guaranteed
Quick shipment and low prices

KNOWLES ELECTROLYTIC PLANTS for the production of hydrogen

Knowles Patented Cells are safe, simple, easy to install, automatic, low in first cost and maintenance, and in addition to flexibility of operation have the advantage of producing also a quantity of pure oxygen equal to 50 per cent of the hydrogen volume. Can be furnished in any size up to 15,000 amperes. Total annual hydrogen capacity of plants now in operation, over one and one-half billion cubic feet.

Our experience as American Manufacturers and Distributors enables us to recommend these plants unqualifiedly.

Write for literature and quotation

International Oxygen Company
American Pioneer Manufacturers of Oxygen
I.O.C.
Main Offices: Newark, N. J.
New York, Pittsburgh, Toledo

WELDING RODS FOR EVERY PURPOSE

WILLIAMS

Weldtlo

Electric and Gas Welding Wire

HIGH-GRADE
LOW-PRICED
GUARANTEED ANALYSIS
ABSOLUTE UNIFORMITY

WILLIAMS & CO., INC.
MANUFACTURERS & DISTRIBUTORS
925-935 PENNSYLVANIA AVE. N. S., PITTSBURGH, PA.
Representing WILSON WELDER & METALS CO. and TORCHWELD EQUIPMENT CO.

Immediate shipment from warehouse. Send for samples of the "new Weldtlo Wire"

Electric Arc Welding Equipment

Transformer Arc Welders (A. C.)
Motor Generator Sets (Direct Current)
Gasoline Engine Generator Sets (D. C.)

A complete line of Electric Welding Accessories always carried on hand.
Electrodes—Holders—Masks—Handshields—Glasses—Cables, etc., etc.

ALLAN MANUFACTURING & WELDING CO., INC.
726 WASHINGTON STREET BUFFALO, NEW YORK

Central New York Representative, Endress Manufacturing Company, Cortland, N. Y.

30% More Welding From Each Tank of Gas, with a

WELDIT GASAVER

GAS consumption stops instantly when torch is placed on hook. Passing the torch tip over pilot light gives same flame adjustment instantly.
No time or gas is lost adjusting flame.
Safety check valve prevents injury to apparatus in case of flashback.

Can be used with all makes of portable and stationary outfits.

Approved by National Board of Underwriters

Welding Torches
Cutting Torches
Regulators
Lead Burning Equipment
Welding Wire
Welding Goggles
Cast Iron Rods
Welding Hose
Brazing Wire
Fluxes & Solders
Safety Gloves
Service

WELDIT ACETYLENE CO.
634 Bagley Ave. DETROIT, MICH.
BRANCH OFFICES
Pittsburgh Cleveland Buffalo
Grand Rapids Gary, Ind. Syracuse

DON'T STRIKE A MATCH

SHOOT-A-LITE

The finest spark lighting device ever made.

SAFE!
SURE!!
STRONG!!!

Satisfactorily solves the lighting problem. Shoots straight to the spot. Stands up under rough usage.

Saves time and money—
Eliminates risk.

WELDERS DELIGHT IN USING IT!

STEVENSON DISTRIBUTING CORPORATION
(Sole Owner)
119-121 E. 27th St., New York

FLEXIBLE SHAFT GRINDERS
TYPE M 6 - ¼ H. P.

Strand
FLEXIBLE SHAFTS

We build many Types and Sizes from 1/10 to 2 H. P. Thousands in use.

Send For Our Booklet B

Manufactured By
N. A. STRAND & CO.
CHICAGO
Factory and Office
5001 - 5009 No. Lincoln St.

RIVETLESS CONSTRUCTION
"Quasi-Arc"
ELECTRODES AND ARC WELDING APPARATUS FOR WELDING IRON AND STEEL
USED BY THE LEADING ENGINEERS INDUSTRIAL CORPORATIONS AND SHIPBUILDERS OF THE WORLD
THE QUASI-ARC WELDTRODE COMPANY INC.
PEEKSKILL NEW YORK

LIQUEFACTION PLANTS
for the Production of
OXYGEN–NITROGEN
Furnished In Any Capacity from 70 Cubic Feet Per Hour Upwards.
HEYLANDT SALES COMPANY
OTTO ADAMS, General Manager
140 South Dearborn Street, Chicago

ACETYLENE WELDING SHIELDS
Our No. 11 Shield, especially for welders who wear correction glasses. You will enjoy the comfort and freedom afforded by it.

This shield is fitted with "ESSENTIALITE" Welding Glass—The glass you will like. Price, $4.00 each, f.o.b. Chicago, Ill.
Sold by all dealers in welding materials, and manufactured by:
CHICAGO EYE SHIELD COMPANY
2360 Warren Ave., Chicago, Ill.

Anti-Borax WELDING FLUX
"ANTI-BORAX"
Oxy-Acetylene Fluxes
are made for every metal and have EXCEPTIONAL merit.
BRAZ-CAST FLUX
For bronze welding of Cast Iron.
We also make the popular "E-Z" Welding Compound for forge welding.
Samples of any upon request.
Anti-Borax Compound Co., Ft. Wayne, Ind.

FOR BETTER OXY-ACETYLENE WELDING
WELD-A-CAST FLUXES
The highest quality Fluxes—at moderate prices.
A special Flux for every metal and every phase of Oxy-Acetylene Welding and Brazing.
Stocked by leading supply houses. If your dealer does not carry it write us direct.
Send for liberal free samples.
Manufactured only by
Cortland Welding Compound Co.
Department C,
Cortland, N. Y., U. S. A.

WELDING ROD HOLDER
FOR THE OXY ACETYLENE WELDER
$1.00
ALL STEEL WIRE BRUSHES
SEND $1.00 FOR 5 ASSORTED BRUSHES
Money refunded on return of goods, if not what you want.
WRITE FOR DEALERS' PRICES
C. SORENSEN, 18 E. 16th ST., CHICAGO

ELECTRIC WELDING MACHINES
In addition to our regular stock we have just added the following:
1— 200 amp. Lincoln welders, a. c. motor drive.
1— 200 amp. U. S. L. welder, gasoline engine drive.
1—1000 amp. Westinghouse welder, a. c. motor drive.
3— 300 amp. transformer type welders.
GOODMAN ELECTRIC MACHINERY CO., 126 Green St., Newark, N.J.

for EYE Protection
IMMUNITE IMMUNIZES EYES
No Ultra Violet
No Infra Red
Absolute Shade Values
Scientifically Certified
STRAUSS & BUEGELEISEN
Front Street, BROOKLYN, N. Y.

ELKONITE

Draw Your Own Conclusions

The remarkable service that Elkonite Welding Electrodes give can best be appreciated by this plain comparison between Elkonite and the material that it replaced in a number of typical operations.

Operation	Previously Used Material	Elkonite
Radio panels	100 welds	8,000 welds
Brass radiator shells	16,000 welds	400,000 welds
Wire to heavy metal	300 welds	12,000 welds
Motor frame assembly	15 welds	400 welds
Wire to tin plate	50,000 welds	2,500,000 welds (incomplete)
Galvanized steel wire	15,000 welds	225,000 welds
Roller bearing assembly	24,000	400,000

Elkonite Welding Electrodes remain hard, *without mushrooming,* under red heat, great pressures and heavy electric currents.

They have made the spot welding of brass, tinned iron, galvanized iron and aluminum commercially practicable.

Especially recommended for severe conditions such as hot upsetting rivets electrically, in facings for clamps for rod welding, split dies for welding steel spokes to both hub and rim of steel wheels, and all classes of flash welding.

WHEN HARD DRAWN COPPER FAILS
: : : YOU CAN DEPEND ON ELKONITE

ELKON WORKS Inc.
Subsidiary of P. R. Mallory & Co. Inc.
Weehawken, N. J.

Exclusive licensees under General Electric Co., patents dated May 28, 1925 and Sept. 1, 1925. Other patents pending to Elkon Works, Inc.

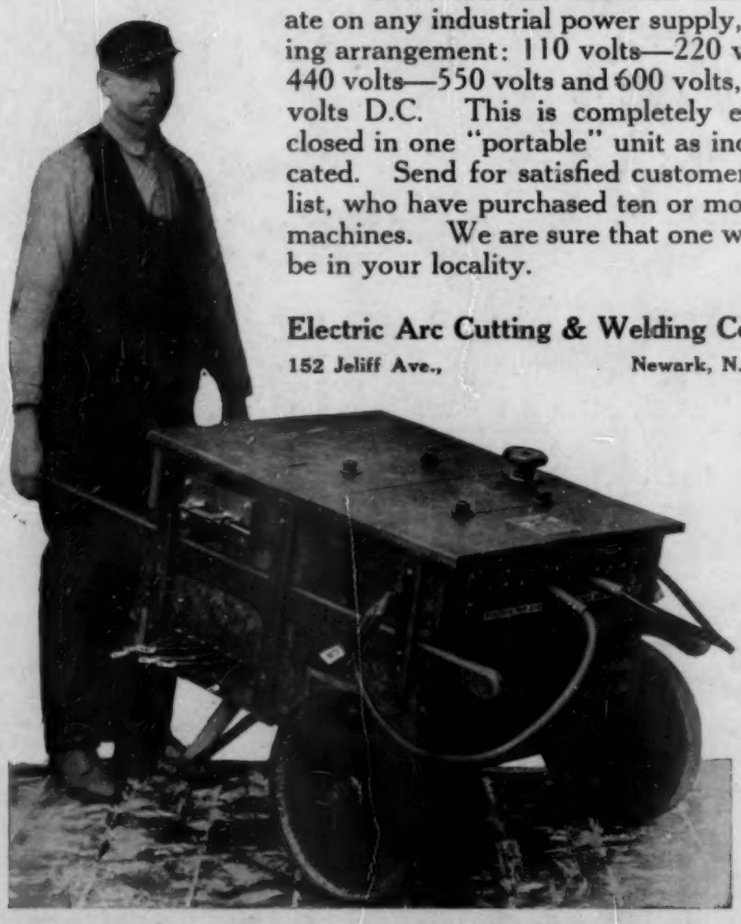
Portability—Durability—Flexibility

Real flexible requirements can be met as needed and the system built up like units in a filing cabinet.

"ALTERNARC"
Transformer Welders

Our "UNIVERSAL" machine can be made to operate on any industrial power supply, any phase or wiring arrangement: 110 volts—220 volts—330 volts—440 volts—550 volts and 600 volts, A.C. 110 and 220 volts D.C. This is completely enclosed in one "portable" unit as indicated. Send for satisfied customers' list, who have purchased ten or more machines. We are sure that one will be in your locality.

Electric Arc Cutting & Welding Co.,
152 Jeliff Ave., Newark, N. J.



110 Volt "Alternarc" Complete

$350.00

Including License

REAL "PORTABILITY"